University of Washington

ARBORETUM BULLETIN

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Concerning this issue. . .

This issue is a veritable forest of trees—their form, their size, and some of their uses.

James Clark writes about the form of deciduous trees, including the selection of an appropriate tree for a garden situation.

In the pleasant early spring, take yourself on a tour of local parks to visit the largest trees in town—Arthur Jacobson describes the most magnificent specimens that we have in Seattle.

And Jan Pirzio-Biroli relates the story of an urban landslide and its subsequent repair, once again thanks to trees.

In the Arboretum, hear the inside story of work on the Camellia Collection, by Sandy Briggs, and the story of the new Conifer Meadow, by Eric Hoyte.

We have two articles that will start you thinking about protecting your plants from pests while protecting your bees from pesticides: Dave Mirgon introduces biological pest management, and P.F. Thurber outlines sensible pesticide use around honeybees.

Sara Hornberger, a veteran Alaska gardener, provides tips for gardening in cold climates.

Enjoy this early spring season, and don't forget the 1983 Arboretum Foundation Spring Plant Sale, May 4 and 5 (see page 2).

SUSAN LIBONATI-BARNES

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COVER

Bigtree or Giant Sequoia *(Sequoiadendron giganteum)* in Leschi Park.
This tree was 110 feet tall in 1955, at the time of the photo.
For more about large trees in Seattle, see page 13.
Photo: Courtesy University of Washington Campus Studios.

1983 Arboretum Foundation Plant Sale

Wednesday, May 4 — 1 PM—8 PM
Thursday, May 5 — 10 AM—2 PM

Arboretum Administration Building Parking Lot

This annual event features choice and hard-to-find plant materials of all kinds, from house plants to rock garden midgets, from species and hybrid rhododendrons to trees and shrubs. Pre-orders will be accepted until April 11.

Help is definitely needed for the set-up day on May 3, for cookie baking, and for the pre-orders. Contact Sarma Davidson, 232-6813.

To donate unwanted plants or pots, please contact Barbara Keightley, 232-3556.

Vines create interest in the garden—vines that twine or climb up and over. Some of the most beautiful are the large-flowering deciduous *Clematis* such as 'Barbara Dibley', one of several available at this year's sale. The eight-inch flowers are cerise with deep cherry bars.

***Clematis* 'Barbara Dibley' flowering in June on the north wall of the northwestern lath house in the Arboretum.**
Photo: J.A. Witt

An aerial view of the Arboretum in spring of 1952. The framework of native and introduced conifers—strong in their pyramidal shapes—is softened by spreading deciduous trees. Among the flowering trees are many dogwoods.
Photo: J.O. Sneddon

The Form of Deciduous Trees — A Closer Look

*JAMES R. CLARK**

Editor's Note: Part of the material found in this paper was presented as a lecture to the Northwest Ornamental Horticultural Society, February 1982.

One of the most striking ornamental features of trees is their overall form. A tree's habit of growth—better termed crown form—is the result of a series of complex physiological interactions. Yet the importance of crown form goes beyond our image of a tree on the horizon. Form plays a significant role in our perception of a given landscape as well as in the maintenance requirements of a tree in that landscape.

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General Crown Forms

Landscape architects and horticulturists have created some general categories of crown form. These are:

COLUMNAR—The height of the tree is several times its width, and the width is fairly uniform from top to bottom. Example: *Carpinus betulus* 'Fastigiata', upright European hornbeam.

An example of columnar crown form: *Quercus robur* 'Fastigiata'. Photo: W. Eng

PYRAMIDAL—The width of the tree is greatest near the ground and tapers to a narrow apex. Example: *Quercus palustris*, pin oak.

OVAL OR ROUNDED—The tree is egg-shaped or spherical in outline. Example: *Acer rubrum*, red maple.

VASE SHAPED—The width of the tree is greatest at the apex and tapers to the ground (the opposite of pyramidal). Example: *Zelkova serrata*, Japanese zelkova.

SPREADING—The width of the tree is greater than the height and the branches are oriented horizontally. Example: *Gleditsia triacanthos* var. *inermis*, thornless honeylocust.

WEEPING—The main stems are oriented vertically but the smaller branches hang freely to the ground. Example: *Salix babylonica*, weeping willow.

Further examples are found in Table 1. The attainment of any of these general forms does not occur at random. Both the genetic makeup of a plant and the environment in which it grows determine the eventual form. Each species or cultivar has a form that it will tend to develop in a given environment. Trees with a strong central leader cannot be pruned as a hedge—their tendency is to develop a strong upright shoot. One practical aspect of this concept is that trying to prune a columnar tree into a round-headed one can be difficult, if not impossible. It is for this reason that plant selection must be based upon crown form in addition to other ornamental features. A mistake in selecting a tree of appropriate form can result in great frustration, large pruning bills, and distorted plants.

The Development of Crown Form

On the simplest level, a tree's crown form results from the differential elongation of shoots—some shoots grow longer than others. In pyramidal forms a single shoot, the terminal, outgrows all others. This results in one strong central shoot or leader as in many conifers. Most rounded, spreading, and vase-shaped forms do not develop this one central shoot; a number of shoots seem to grow equally in length. This results in many major branches, a more open crown, and rounded outline.

If the differential growth of shoots results in a tree of a given form, then what controls this differential growth? How does the plant regulate which buds grow, as well as the length of the growing period? To a small extent elongation of a bud can be determined by the presence or absence of a terminal flower cluster. If a branch ends in a flower bud, no vegetative growth is possible. Any future shoot growth must come from a lateral (side) bud (or buds), a situation which may encourage branching. Still, the question of which buds grow is not answered by this observation. To address that question, two physiological mechanisms must be discussed—apical dominance and apical control.

Apical dominance is the inhibition of the growth of lateral buds by the terminal bud on a *current season's shoot*. Put another way, on a growing shoot the terminal bud may prevent the lateral buds from growing. On a plant with weak apical dominance some laterals may overcome this inhibition and grow, as in sweetgum (*Liquidambar styraciflua*). Plants like *Gleditsia triacanthos* that have strong apical dominance would not have any lateral bud

growth on a single year's growth. Since apical dominance regulates only the growth on a current season's shoot, lateral buds on two- and three-year-old stems may be released from inhibition and form lateral branches.

We see the phenomenon of apical dominance at work in a number of routine gardening practices. Pinching of the tips of herbaceous plant material is one way to circumvent apical dominance and permit lateral buds to develop, thereby producing a "bushier" plant. The production of asparagus spears is regulated by apical dominance, in that spears develop from lateral buds and may be inhibited by the terminal shoot of the crown. In fact, research aimed at eliminating this inhibition (and increasing the number of spears produced) is ongoing. Pruning of fruit trees to stimulate side branching is another way of removing the inhibitory influence of the terminal bud.

Apical dominance is caused by a combination of hormonal and nutritional factors, but the precise mechanism is not very well understood. It should be emphasized that apical dominance regulates the growth of buds only on a *current* year's shoot.

Apical control, on the other hand, is the regulation of a plant's form over *many years of growth*. Apical control refers to the ability of one shoot to outgrow all others over many years. Thus, pyramidal (and many columnar) forms are said to exhibit strong apical control, precisely because we can identify a single *terminal* shoot, as in *Liquidambar, Liriodendron*, and *Quercus palustris*. These trees possess a strong central trunk or leader. Trees with rounded, spreading, or vase-shaped forms lack this single main stem; many large branches develop, as in *Gleditsia, Acer macrophyllum*, and *Ulmus americana*. Such trees are said to have weak apical control.

Thus, the differential growth of buds is regulated by two mechanisms—one controlling growth on a current season's shoot (apical dominance) and a second controlling growth of buds over the long-term (apical control).

Growth Habits

Trees that have a single main trunk or central leader are said to possess an *excurrent* growth habit. Most pyramidal trees as well as some columnar and weeping types develop such a main stem. The opposite situation—no main trunk—is found in most spreading, oval, rounded, and vase-shaped forms. This is called a *decurrent* habit.

One year's growth of two different trees.
Above: Maple *(Acer)* twigs exhibiting strong apical dominance. Below: Sweetgum *(Liquidambar)* twig with weak apical dominance. Photos: J. Clark

At first glance, trees with strong apical control (excurrent types) such as *Liriodendron* would appear to possess strong apical dominance as well, while decurrent trees, like *Aesculus*, would have both weak apical dominance and weak apical control. However, this is not generally true.

If we examine the growth of a seedling sweetgum (*Liquidambar styraciflua*) with a pyramidal form and excurrent habit, the true relationship of apical dominance and control can be elucidated (Figure 1). After germination of the seed, a single shoot which has weak apical dominance develops, and therefore, some growth of the lateral buds occurs. In subsequent years, however, the terminal shoot retains its superior position, and outgrows all the shoots from lateral buds (Figure 1). Thus,

Tulip tree *(Liriodendron tulipifera)*, with a pyramidal crown form and a strong central leader. Photo: J. Clark

a *combination* of weak apical dominance and strong apical control results in a crown form with a strong central leader.

The opposite situation exists for the decurrent habit (Figure 2). In this situation, the newly-germinated shoot exhibits strong apical dominance. Yet in the following year some lateral buds expand and may outgrow the terminal, leading to an open, spreading crown. Such trees have strong apical dominance but weak apical control (as no single shoot outgrows all others).

The above examples are representative of how the forms of deciduous trees develop. In conifers, a somewhat different pattern is exhibited. Genera such as *Pseudotsuga, Pinus, Picea, Cedrus,* and *Abies* usually develop into a pyramidal form with a strong central leader. But these species exhibit both strong apical dominance and strong apical control, unlike deciduous trees like *Liquidambar* or *Liriodendron*. Why the conifers and deciduous trees develop in different fashion is not known.

Neither the physiological mechanism of apical control nor the precise nature of the interaction between dominance and control is known. Yet these two mechanisms are closely related, and their interaction is an extremely important physiological process.

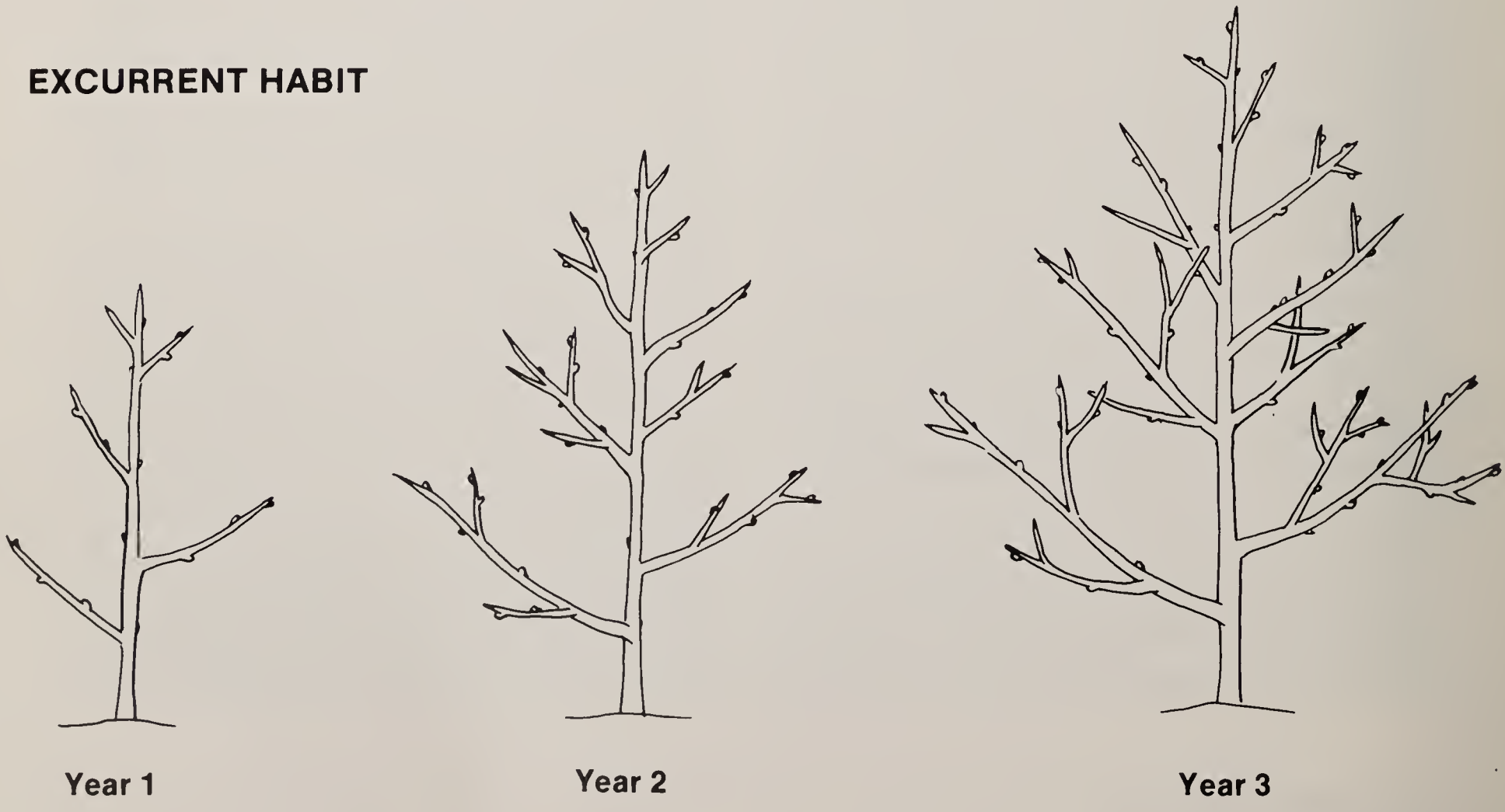


Figure 1. Development of the excurrent growth habit. On a developing shoot, lateral buds may elongate. However, over the three years shown, the terminal shoot elongates to the greatest extent. Drawing: Andrew Gorski

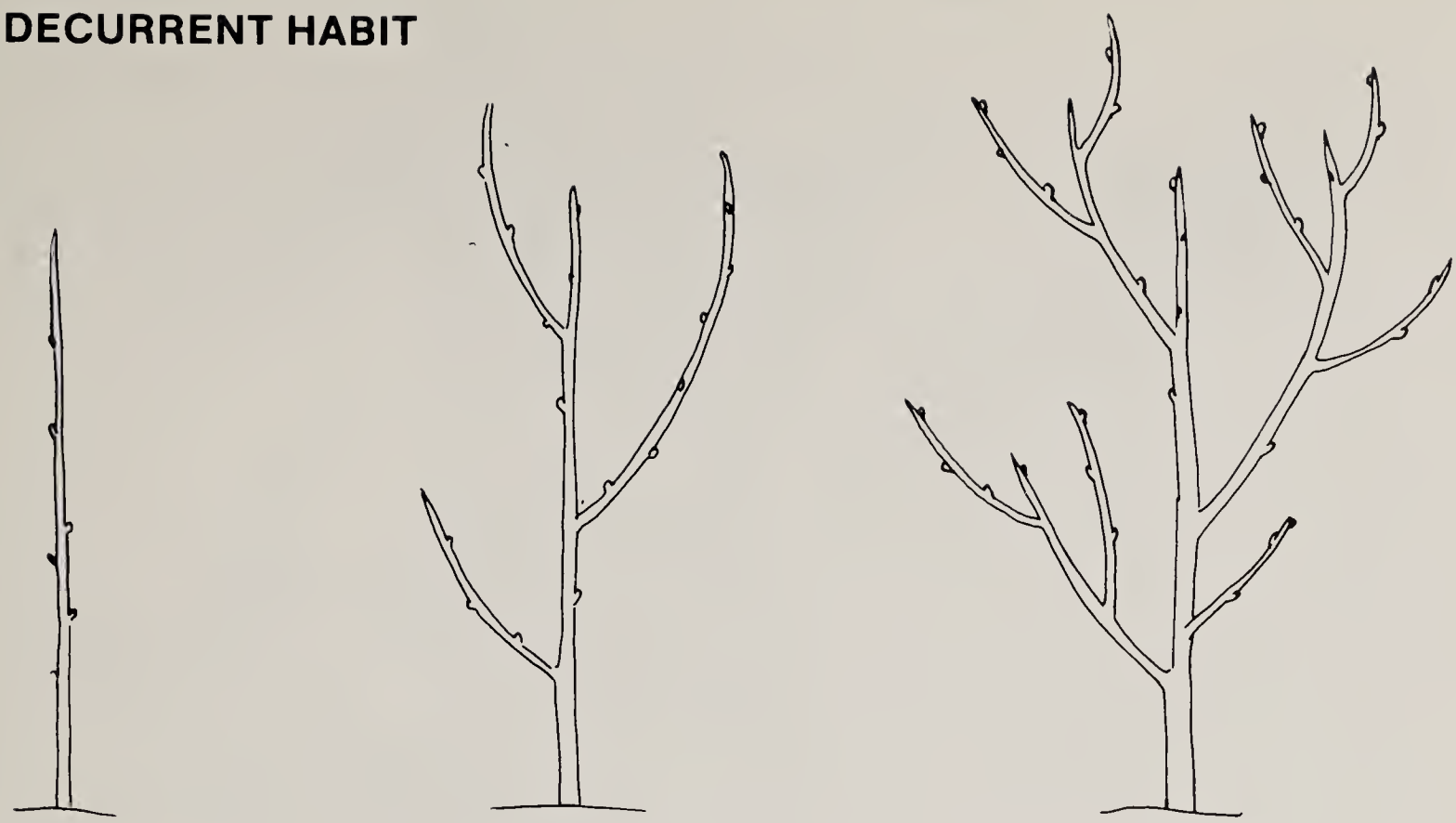


Figure 2. Development of the decurrent growth habit. On a developing shoot, no lateral buds elongate. Yet, over a few years' growth, no single shoot "out-grows" all others. **Drawing: Andrew Gorski**

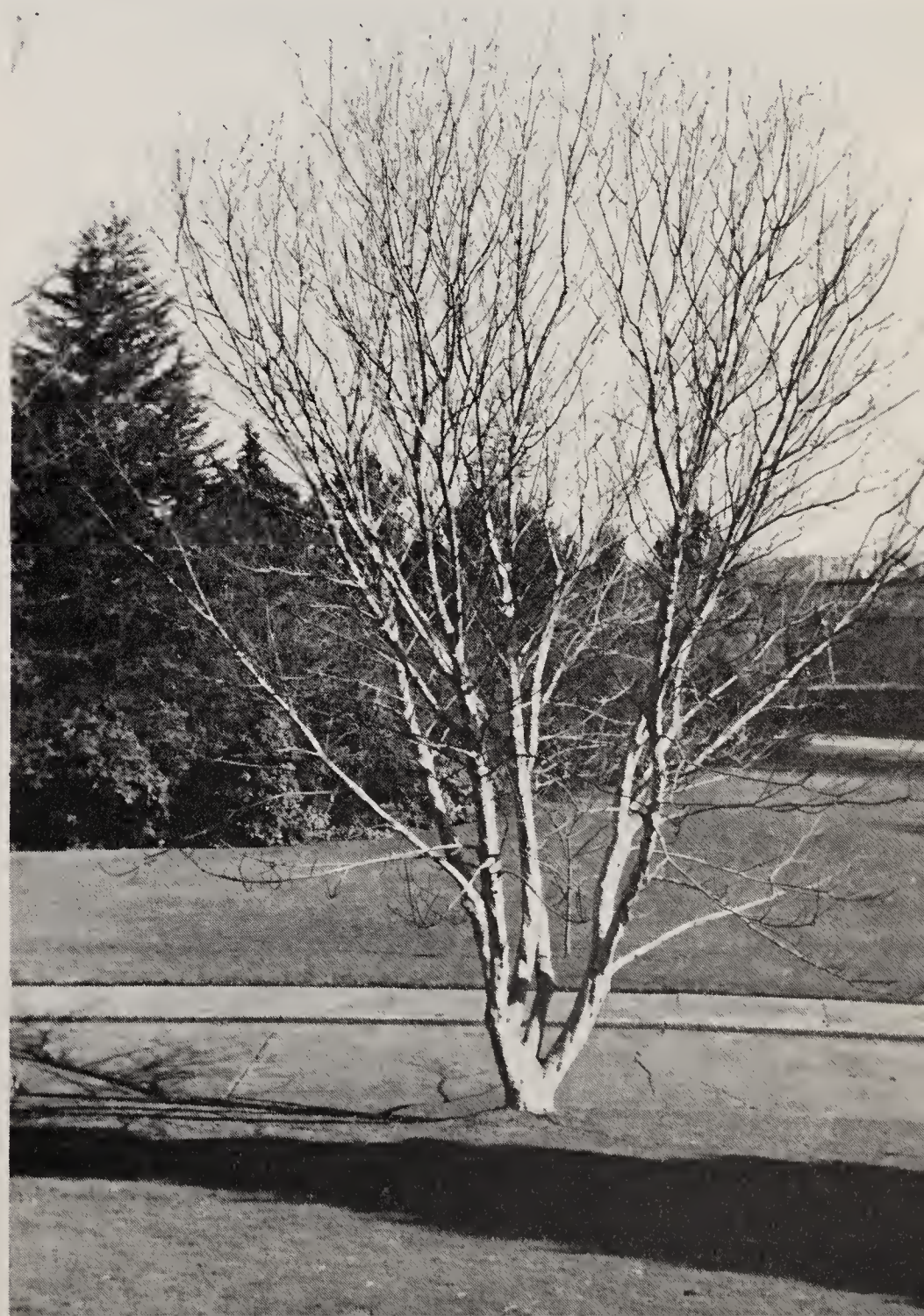
Light Intensity and Crown Form

As previously stated, crown form is controlled not only by a plant's genetic composition but by the environment as well. Of the various environmental factors, light intensity is the most important. The effects of heavy shade are readily evident in the coniferous forests of our area. Under heavy shade many conifer species such as Pacific silver fir (*Abies amabilis*) will develop a flat-topped, wide spreading form quite unlike the typical pyramidal form of the species.

Deciduous tree species will also respond to low light conditions. Many species which typically have a strong central leader (such as *Liriodendron* and *Liquidambar*) lose this leader when grown under heavy shade, and take on a multi-branched form. Additionally, low light conditions cause very flat branching patterns to develop.

Another influence of light intensity on crown form happens when shading occurs from one direction rather than from all directions. The response we observe is that a tree "grows toward the light," and the unshaded portion may vigorously outgrow the shaded portion. Under such conditions, the "typical" or desired form may be lost and an irregularly shaped or spindly tree may develop.

The California buckeye *(Aesculus californica)* is a prime example of the decurrent growth habit. Note the complete lack of a central leader. This is also a good example of weak apical control. **Photo: Nancy Walz**



An airy windblown pattern against the sky, characteristic of the crown of *Robinia* with its decurrent development, generates the ease of informality in the landscape. **Photo: J. Clark**

Form as an Architectural Element

Landscape architects are concerned with crown form from another perspective—that of its role as a design element in the landscape. Aside from ornamental features such as leaf texture or flower display, crown form can be used to alter the manner in which we perceive a given landscape.

Forms that are primarily vertical in orientation—pyramidal, columnar, and some narrow ovals—lead the viewer's eye upward, emphasizing vertical space. Such a vertical emphasis gives one a sense of height and narrowness. The giant sequoia (*Sequoiadendron giganteum*) planted in the Times Square area downtown (4th & Olive & Stewart) provides an example of this psychological effect. In general, trees of upright outline fill just this role in the landscape: catching and holding the eye.

Forms with a more horizontal orientation—spreading or rounded—emphasize a broad view of a landscape. These forms lead our eye from side to side, emphasizing lateral spaces. Such a view gives a sense of continuity and evenness in the landscape. The plantings of London plane (*Platanus* x *acerifolia*) and honeylocust (*Gleditsia triacanthos* var. *inermis*) in the Pioneer Square area serve to emphasize the breadth of that space, and to keep us oriented in a horizontal frame.

Weeping forms lead our eye back to the ground, and keep our view oriented there. These forms are also accents in the landscape. The poplars in the Arboretum, and the willows near Mt. Baker Park along Lake Washington Boulevard, are good examples of this form and its effects.

In general, trees with extreme form—very narrow as in *Sequoiadendron* or pendulous as in *Salix babylonica* and *Prunus subhirtella* 'Pendula'—hold our attention for relatively long periods of time, and thus are true focal points in the landscape.

Practical Considerations of Crown Form

Since the development of crown form is not a random event, selection of the proper form for a given situation is a necessity. As previously discussed, it is very difficult to prune a single-leader tree to control height. The ten-

Excurrent tree habit strikes notes for two seasons.

Right: A planting of four tulip trees *(Liriodendron)* lends an air of stately summer grace to 15th Avenue NE, south of NE 45th Street. Photo: W. Eng

Below: The strongly vertical trunks of sweetgum *(Liquidambar)* provide an accent for winter. Photo: J. Clark

dency of most pyramidal trees is to develop a strong central leader. Removal of that leader usually results in the formation of a new one. It is next to impossible to prune excurrent trees into any other form.

There are numerous situations where the inappropriate form can result in problems. Planting pyramidal or weeping forms over sidewalks or parking lots will necessitate frequent pruning to keep the branches off cars and walks. Rounded or vase-shaped forms planted under utility wires will also require pruning to keep the lines clear. Although spreading and vase-shaped trees are picturesque, their branches often interfere with power lines and/or hang over roofs.

Form plays a role in how we view a landscape as well as in the esthetic and functional beauty of that landscape. Consideration of a tree's form is an essential part of the process of matching species, site, and function.

Table 1. Specific examples of the major crown form groups.

COLUMNAR	
Carpinus betulus 'Fastigiata'	Upright English Hornbeam
Cedrus atlantica 'Fastigiata'	Upright Atlas Cedar
Ginkgo biloba 'Fastigiata'	Sentry Ginkgo
Pyrus calleryana 'Chanticleer'	Chanticleer Pear
Sequoiadendron giganteum	Giant Sequoia
PYRAMIDAL	
Liquidambar styraciflua	Sweetgum
Quercus palustris	Pin Oak
Pinus sp.	Pine
Picea sp.	Spruce
Sequoia sempervirens	Coast Redwood
OVAL OR ROUNDED	
Acer macrophyllum	Bigleaf Maple
Acer rubrum	Red Maple
Fraxinus sp.	Ash
Magnolia soulangiana	Saucer Magnolia
Quercus sp.	Oak
VASE-SHAPED	
Ginkgo biloba	Ginkgo
Prunus serrulata 'Kwanzan'	Kwanzan Cherry
Prunus serrulata 'Ukon'	Ukon Cherry
Ulmus americana	American Elm
Zelkova serrata	Japanese Zelkova
SPREADING	
Acer palmatum	Japanese Maple
Cercis sp.	Redbud
Cornus florida	Flowering Dogwood
Cornus kousa	Japanese Dogwood
Gleditsia triacanthos var. *inermis*	Thornless Honeylocust
Styrax japonica	Japanese Snowbell
WEEPING	
Betula pendula	Weeping Birch
Fagus sylvatica 'Pendula'	Weeping English Beech
Morus alba 'Pendula'	Weeping Mulberry
Prunus subhirtella 'Pendula'	Weeping Higan Cherry
Salix babylonica	Weeping Willow
Ulmus glabra 'Camperdownii'	Camperdown Elm

Chestnut *(Castanea)* on the campus of the University of Washington—shading from the right has caused these trunks to lean to the left. **Photo: J. Clark**

SUGGESTED READING

Brown, C., R. McAlpine and P. Kormanic. 1967. Apical dominance and form in woody plants: A reappraisal. American Journal of Botany 54:253-262.

Harris, R. 1980. Structural development of trees. Journal of Arboriculture 6:105-107.

Nelson, W. 1975. Landscaping your home. Circular 1111, Cooperative Extension Service, University of Illinois Urbana-Champaign. Extension Service, University of Illinois Urbana-Champaign.

Book Reviews

GARDENING IN THE SHADE, by Harriet K. Morse. Timber Press, Beaverton, Oregon, 1982 (reprint). 242 pages, 33 black and white photographs, numerous lists of plant materials, a directory to plants and habitats, and an index. Price: $12.95

Gardening in the Shade is a 1982 reprint of the 1962 paperback revised edition of a book first printed by Charles Scribner's Sons in 1939. For the 1962 edition, Mrs. Morse revised and enlarged the first volume, inserting considerably more detailed descriptions of the plants. The original black and white photographs were superb—better, I think, than many that were substituted for them in the 1962 revision. Both of these earlier editions of what has become a classic reference have been out-of-print for some time and are scarce, even in the second-hand book trade. The current edition appears to be an exact reproduction of the 1962 book although it is stated on the back cover that "the new edition of GARDENING IN THE SHADE has been considerably revised and enlarged and should be more useful than ever to a multitude of gardeners." A cursory page scan of the three volumes has uncovered no significant differences between the last two editions other than the statements on the backs of the two books.

Almost every garden has at least a small area of shade. Some have areas where little or no sun penetrates or where the sun is filtered or obscured for part of the day. In the first part of this book, Mrs. Morse describes these various situations and offers very practical suggestions on how to deal with each one, suggesting plants which might do well in the varying circumstances. She writes with flair and considerable ingenuity. Each descriptive chapter is followed by a resume of suggested plant material mentioned in that section. Her prose conjures up pictures: "A chipmunk will sit on his haunches and blink at us from the great rock over there and we forget to wonder if it was he who ate last year's lily bulbs. . ." and "The great flat, shiny black beetle which hides under rocks is a great caterpillar hunter. That drab-colored creature which looks like an overgrown and slightly weary horse fly works good deeds for us, too." Under a section entitled GROTESQUES is this gem: "What are those weird signs of life on the woodland floor in earliest spring, those strange outcroppings among the sere brown leaves in moist low spots? Skunk cabbage in embryo! Soon the whole locality will burst forth with absurd green tufts, and once more the woodland comes into its renaissance."

The second part of the book is an extensive directory of plants, including their native habitats, characteristics, and potentialities. The descriptions are explicit, including the needs of the plants, and arranged under these subtitles—Annuals, Aquatics, Tropicals, Bulbs and Allied Plants, Ferns, Herbaceous Perennials, Deciduous Shrubs and Trees, Evergreens, and Vines. This directory is helpful as a reference when one is trying to choose a plant for a difficult area.

Often, when I have dipped into my 1939 copy of *Gardening In The Shade,* I have found myself wondering, "Now, why didn't I think of that!" It is thanks to Harriet Morse that I am now enjoying a little fern alley between a steep bank and a row of trees where there used to be a patchy and well-trodden grassy path. I think this book is one of the tried and true treasures which is read and re-read throughout the years. This volume in the Timber Press Horticultural Reprint Series should be welcomed by gardeners not so fortunate as to possess the earlier revised edition.

NAN BALLARD

THE COMPLETE TREES OF NORTH AMERICA, by Thomas S. Elias. Van Nostrand Reinhold Company, New York, 1980. 948 pages, 650 range maps, 1400 labelled drawings. Hard cover. Price $19.95.

Any book entitled "The Complete Book of . . ." always entices this reviewer to more critically review its contents. This volume is one of the Outdoor Life/Nature Book Series and as such is written for ease of understanding for the amateur horticulturist. It is not intended for the plant specialist who will more quickly use the texts of Rehder, Bailey, or Hitchcock for plant identification.

The volume is designed to help the amateur quickly identify over 750 North American trees, including 652 natives. It is based on a system of simple keys, supported by excellent illustrations. The majority of the drawings were originally done by Charles Edward Faxon, and taken from the 1905 edition of Charles Sargent's *Manual of the Trees* and from the Faxon and Mary Gill drawings in the 1922 edition of the Sargent book.

The author has chosen to divide the volume into simple taxonomic categories—conifers (gymnosperms), flowering plants (angiosperms), hardwoods (dicots), and yuccas (monocots). Once the reader has identified the proper group, then a key is used to determine the family, genus, and species. Obviously if the particular tree to be identified is not one of the 750 included, then the reader must consult another text.

The author uses simplistic terms. For example, "coriaceous, pinnately compound leaves" are reported as "leathery, feather-like leaves." These simple terms, as well as accurate drawings, are useful for easy identification once the plant is keyed to a proper choice.

The reader is also supplied with brief descriptive information on each tree's growth habits, its importance to wildlife, and its usefulness for timber and/or fuel. The range map is a valuable asset for easily determining the natural range of the trees. However, this is of no help in identifying trees planted outside their native environment by enthusiastic gardeners.

The author uses the first chapter to describe the basic characteristics associated with leaves, needles, fruit, etc., which the reader must understand. These characteristics are presented in simplistic terms and cover the most common shapes and forms to be found. The "Winter Key to Hardwoods," found last in the volume, seems almost an after thought and should be either expanded or eliminated.

The author is Assistant Director of the Cary Arboretum of the New York Botanical Garden. He has studied and traveled widely and written about trees extensively. In this volume he has compiled a reference which should be extremely useful for amateurs in identifying the most commonly found trees in North America. For advanced plantspeople who desire detailed information on additional trees and more technical descriptions, other manuals would be useful.

JOHN A. WOTT

AN ILLUSTRATED GUIDE TO THE ENDANGERED, THREATENED AND SENSITIVE VASCULAR PLANTS OF WASHINGTON. The Washington Natural Heritage Program, 1981. 334 pages, including numerous line drawings, distribution maps, and index. Price: $6.00

In the preceding decade, increasing concern over our diminishing flora has incited professional botanists to generate lists of threatened and endangered (T & E) plant species based upon field surveys and herbarium specimen data. As a result of this activity, the State of Washington and The Nature Conservancy have created The Washington Natural Heritage Program. This program has inventoried natural communities and T & E species and has helped to set priorities for conservation from these data. All available data on proposed T & E species were collated, and species lists were published which included the statewide degree of jeopardy.

For those who possess intimate knowledge of Washington's flora, a glance at the list provides an instant picture of the T & E plants of this state. But for less experienced botanists, amateurs, or resource managers who must manage for these species on county, state or federal lands, the lists are merely enumerations of latin binomials. To make this information more accessible for this latter group of people, the Washington Natural Heritage Program secured funds from the U.S. Forest Service and the Washington State Department of Natural Resources to publish *An Illustrated Guide to the Endangered, Threatened and Sensitive Vascular Plants of Washington.*

The book expands upon the list by including line drawings of the plants, descriptions of prominent characters, distribution maps, and habitat preferences—all on the same page. Immediately an image of the plant and its habitat is obtained, allowing one to read on and learn about other species which might be confused with it, the time of year when the plant is identifiable, the range of distribution outside of Washington, the number of recent sightings, the known and predicted threats, the ownership of the lands where it grows, and its endangerment status at the state and federal level.

Preceding the list of T & E plant species is an introductory section which outlines the historical development of the Washington program, and most importantly, details the methodology employed to determine the endangerment status assigned to each plant species.

This book will be of interest to those who are concerned about the downward spiral of natural diversity in this state's native flora, and especially to those who are interested in exploring our wildlands in search of T & E plants. In fact, for those of you who successfully identify one of our listed species, your details about site location and status of the population are data which would be greatly valued by the Washington Natural Heritage Program.

The book is not readily available in bookstores, and must be purchased directly from the Washington Natural Heritage Program, 3111 Seminar Building (SE 3109), The Evergreen State College, Olympia, WA 98505.

BONNIE TUCKER

HERE

Light begins to slope
into morning,
shadows become delicate.
One warm breath could melt them.

While the room is remembering
its corners, the maidenhair fern
its finest edges, the last shadows
are leaving the refuge of your hair.

Here are the first stirrings
in the thicket of your bones.
Outside, I hear the small sounds
gathering.

Melinda Mueller

From *PRIVATE GALLERY,*
The Seal Press, Seattle

This elegant madrona *(Arbutus menziesii)* at Martha Washington Park may be the largest in Seattle. It is 75 feet tall and has a trunk more than seven feet in diameter, dwarfing the figure at the base (page 16). Photo: G. Ferber

Tall Tales from the Northwest — Big Trees of Seattle

ARTHUR LEE JACOBSON

History of Seattle's Trees

Reviewing the history of trees in Seattle makes clear why the city today is so delightfully rich in trees. The first settlers arrived in the 1850's and lost no time in beginning their logging operations. Over the hills they roved, everywhere faced with a seemingly unlimited supply of tall timber growing in dense wilderness. The loggers took some trees, and left some, rather sporadically and erratically in general. Different landowners and logging outfits pursued different policies.

Seattle was not laid bare from one vast, ugly clear-cut, but some parts of it were. Today a number of the original trees have achieved great stature, having survived the logging, urbanization and other threats we humans can impose. In many cases we can't tell for sure whether a tree standing today is an old one ignored by loggers, or a second-growth one that grew exceptionally quickly. Some parts of the city were logged very early, others much later, some more than once. Even the old-growth forest preserves at Schmitz and Seward parks were partly logged and disturbed.

In 1909 Seattle sponsored the Alaska-Yukon-Pacific Exposition. By this time the city was enriched with a diverse network of parks and boulevards, covering many acres of prime land. Book descriptions, postcards and photographs of the period reveal three categories of trees: old-growth natives, second-growth natives, and non-natives.

During this period, trees from Europe and other parts of North America were first extensively planted, albeit side by side with native trees like the dogwood (*Cornus nuttallii*), western red cedar (*Thuja plicata*), and the most planted tree of all—bigleaf maple (*Acer macrophyllum*). The result of these early tree-planting practices has been a healthy variety of trees in our parks: old and young, native and non-native, in formal and informal settings.

Some of the non-native trees that were widely planted by the 1920's are now reproducing here, some extensively naturalized. For example the European mountain-ash (*Sorbus aucuparia*), one of which has achieved a height of over 65 feet, seems to be of record size. It is one of several naturalized non-natives that owe their status to the dissemination of their seeds by birds. Holly, Mazzard cherry, hawthorn and cherry laurel are similarly dispersed.

As the century advanced, Seattle acquired many new parks, including the Washington Park Arboretum. A thriving nursery trade supplied Asian trees like the dovetree (*Davidia involucrata*), Persian ironwood (*Parrotia persica*), Oriental sweetgum (*Liquidambar orientalis*), and Asiatic birch (*Betula albo-sinensis*). As population grew, that many more people enhanced their yards with gardens and trees. We now have a full-time Arborist to oversee and care for the thousands of street-trees, most of which have been planted on arterials in the last decade.

We will now consider a selection of parks in Seattle particularly noteworthy for outstanding trees, especially *big* ones. When we claim that a certain park has the largest individual of a certain kind of tree, we are relying on what we have observed in Seattle; in some cases it could very well be that yet larger trees exist. Also, note that the size of a tree is a measurement not only of the height, but also of the thickness of the trunk and the spread of the branches. So while a very tall and slender tree might be the tallest, another tree could still be called the largest.

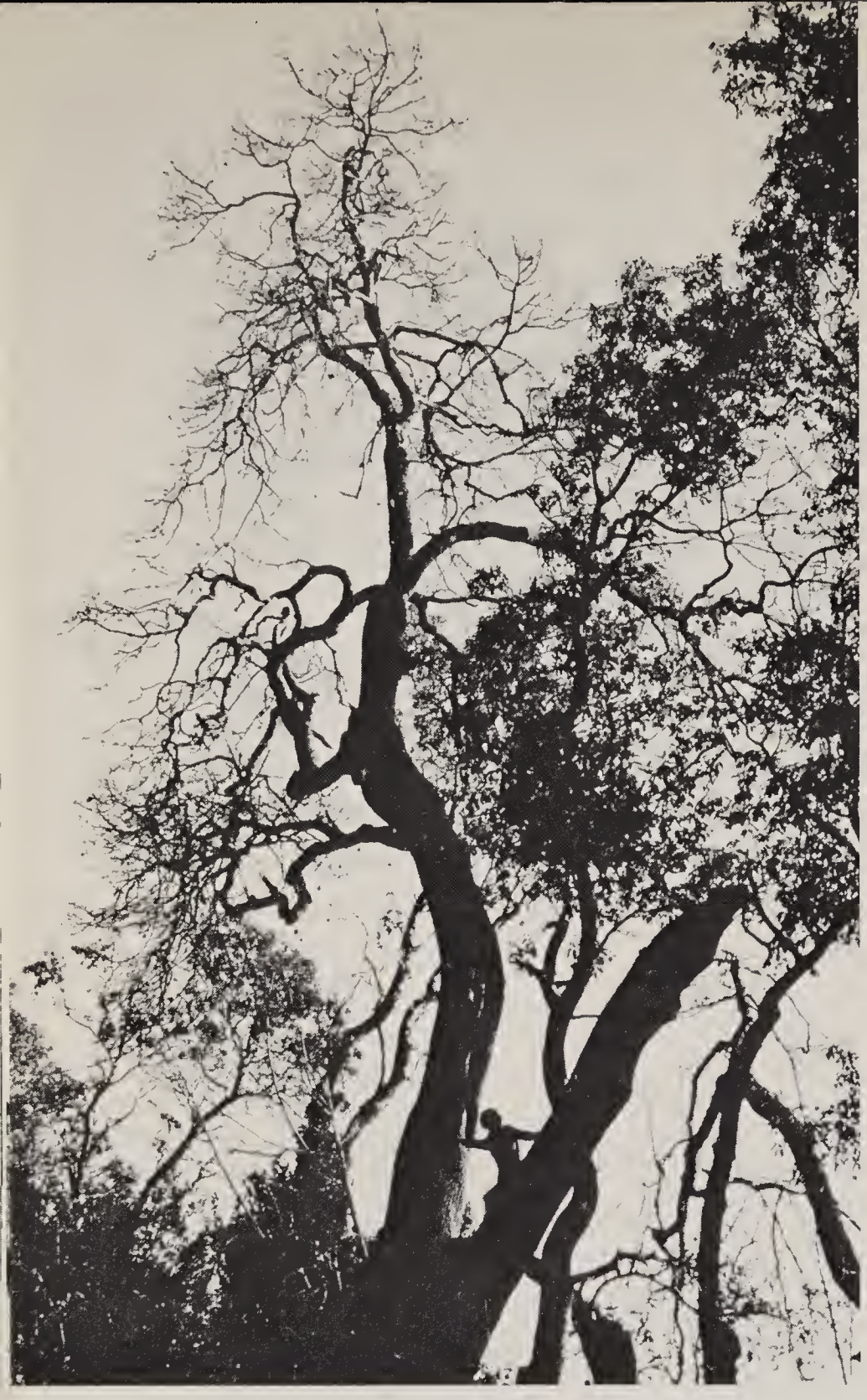
This western red cedar *(Thuja plicata)*, though by no means the largest in Seattle at 140 feet tall, is found near the road into Schmitz Preserve Park. Photo: G. Ferber

SCHMITZ PRESERVE PARK, 50 acres of forested ravines in West Seattle not far from historic Alki Point, is cited on Kroll's map of Seattle as "The only virgin forest tract in any western city." But this is neither the only tract of land with virgin old-growth trees, nor necessarily the best. Like the other parks in town that have some old-growth trees, Schmitz Park was partly logged, and contains some non-native trees and other introduced plants. It has the biggest and tallest grand firs (*Abies grandis*) in Seattle, in the vicinity of the parking lot. Professor Krishna Rustagi (of the University of Washington's College of Forest Resources) and I established one such tree (the top of which recently dropped all its needles) as about 185 feet in height. The thickest trunk is over 5 feet in diameter. Schmitz Park also has the city's largest hemlock (*Tsuga heterophylla*), with a trunk diameter exceeding 3½ feet, and western red cedars of a size only matched by some at Seward Park. Some of these have trunks so hollowed out by rot and fire that a person can walk through the tree—in one side and out the other. A significant percentage of the towering old Douglas firs (*Pseudotsuga menziesii*) at Schmitz and other parks have dead or broken tops. Observing the thickness of the trunks at the point where the tops were lost to the wind, it is obvious that some of these trees once stood 300 feet tall or more.

LINCOLN PARK in southwest Seattle, is large and rich in trees, both native and non-native. It has a few impressive Douglas firs which are remnants of the old-growth forest. The largest is near the north end of the park, about 20 yards from the beach. In general the steep hillside is forested with native trees, while the top, flat part of the park has natives plus numerous introduced trees. Especially interesting are its rare hardy rubber trees (*Eucommia ulmoides*), yellow-woods (*Cladrastis lutea*), goldenrains (*Koelreuteria paniculata*), gigantic English yews (*Taxus baccata*), and Japanese red pines (*Pinus densiflora*). Although most of the other trees in this park are only average in size, their variety and the manner in which they were planted in groves makes for a fine collection of trees.

SEWARD PARK is the 275 acres of Lake Washington's Bailey peninsula, facing Mercer Island. Quite a few of its trees have been cut, but a significant portion of the park is still essentially old-growth forest. A pair of ospreys were nesting there recently. Several different forest types are represented at Seward Park: coniferous forest of Douglas fir, western red cedar, hemlock, and yew; broadleaf forest of maple and cherry; wetlands with ash, cottonwood, alder, and willows and dry bluff with oak and madrona. Many non-natives are planted here, especially around the perimeter of the park. Because of Seward Park's size and unusual diversity, it is fair to call it Seattle's best park for trees. It has a Pacific yew (*Taxus brevifolia*) 64 feet tall, with a trunk nearly 2½ feet in diameter. As this is probably the region's slowest-growing tree, it must have taken several hundred years to attain that size. A Scouler willow (*Salix scouleriana*), is slightly larger. This willow is one of the fastest-growing species in our region. As in the case of the

An abundantly burled maple can be found at Seward Park.
Photo: G. Ferber



A grand wreck of an oak with trunk hollowed and limbs lost to storms, it stands 75 feet tall in Martha Washington Park. Photo: G. Ferber

yew, records of larger specimens are extremely rare. In part of the dense forest madronas raise up straight trunks about 100 feet tall. There are also some very large hemlocks (*Tsuga heterophylla*) and Douglas firs, a few of which have their trunks ensheathed with poison oak *(Rhus diversiloba*) to a height of 75 feet.

MARTHA WASHINGTON PARK is close to Seward Park, but most people have never heard of it and most maps do not show its 10 acres at the end of 57th Avenue South on Lake Washington. It has huge, noble and picturesque madronas (*Arbutus menziesii*) and Oregon white oaks (*Quercus garryana*) several centuries old. At only 75 feet, their heights are not spectacular, but the mammoth size of their trunks and limbs must be seen to be believed.[1]

[1] *Arboretum Bulletin* 42(1):8, Spring 1979.

Some unusually large non-natives have also attained great size (in Seattle's context), the California laurel (*Umbellularia californica*) and Austrian pine (*Pinus nigra*). An old orchard supplies cherries and apples in the summer.

LESCHI PARK is a small old park near Lake Washington, a mile north of the Mercer Island Bridge. Most of its trees are non-native and of significant size. Several are close to, or over 100 feet in height: bigtree (*Sequoiadendron giganteum*), silver maple (*Acer saccharinum*), tuliptree (*Liriodendron tulipifera*), and sawara cypress (*Chamaecyparis pisifera*). A rare Hiba arborvitae (*Thujopsis dolabrata*) is 50 feet tall, an Oriental arborvitae (*Thuja orientalis*) is 25 feet tall, and fair-sized American elms (*Ulmus americana*), European beech (*Fagus sylvatica*), English maple (*Acer campestre*), witch hazel (*Hamamelis*) and Caucasian fir (*Abies nordmanniana*) are present too. The size of the trees is mostly due to their unusual age—nearly 100 years for the oldest.

THE WASHINGTON PARK ARBORETUM has countless non-native trees which are rare elsewhere in Seattle, and it also has some native trees of record size in the city: a Pacific crabapple (*Malus fusca*) about 50 feet tall, and a vine maple (*Acer circinatum*) with a single trunk over a foot thick. In general its biggest, oldest and most impressive non-natives are those along the boulevard which cuts through the park. Regular classes about trees are offered, and guided tours conducted to see them.

BOREN/INTERLAKEN PARK consists of the forested ravines of the northeastern slope of Capitol Hill. A boulevard meanders through and connects with the western part of the Arboretum. Some 140 different kinds of trees grow in these parks. Boren Park is a very special six-acre ravine within Interlaken Park. In this secluded and rarely visited ravine grow the city's tallest cottonwoods (*Populus trichocarpa*, 140 feet tall), Pacific willow (*Salix lasiandra*, 70 feet tall), and cascara (*Rhamnus purshiana*, 60 feet tall). Some of the maples easily exceed 100 feet in height; one has a trunk approximately 24 feet in circumference! Wildflowers like bleeding heart (*Dicentra), Trillium*, wild ginger (*Asarum caudatum*), enchanter's nightshade (*Circaea alpina*) and fringecup (*Tellima grandiflora*) also grow here

in great luxuriance.

The rest of Interlaken Park also has notable trees, both native and non-native: western red cedars spared by the loggers, hemlocks infected with dwarf-mistletoe (*Arceuthobium*), California hazels *(Corylus cornuta* var. *californica)* over 40 feet tall—a size unreported anywhere else; a 90-foot Mazzard cherry (*Prunus avium*), a 75-foot China-fir (*Cunninghamia sinensis*), a 65-foot mountain-ash (*Sorbus aucuparia*), and a 130-foot redwood (*Sequoia sempervirens*). Others are gigantic trees of Norway maple (*Acer platanoides*), cherry laurel *(Prunus laurocerasus*) and crack willow *(Salix fragilis*). Perhaps no park in Seattle is so rich in trees yet so little known. Nowhere is there a sign giving the name of this park.

DISCOVERY PARK, at over 500 acres, is Seattle's largest park. It has the city's biggest dogwood (*Cornus nuttallii*) and bitter cherries (*Prunus emarginata*), along with fine alders and maples. A great many non-native trees are represented, some of which are outstanding, such as the ponderosa pines (*Pinus ponderosa*) and an apple tree over 70 feet tall, drilled from top to bottom by a sapsucker. Many programs, classes, and some publications are offered—all to help people understand and appreciate the environment.

GOLDEN GARDENS PARK is known primarily as a saltwater park near Shilshole Bay. A fair forest mostly of native trees, including some possible old-growth, covers the steep unstable hillside above the railroad tracks. The tree which makes the park so special is a red alder (*Alnus rubra*) with a tremendous trunk very nearly five feet in diameter. Certainly one of the most spectacular trees in the city, it has no peers. It is near the railroad tracks right at the park's northern boundary.

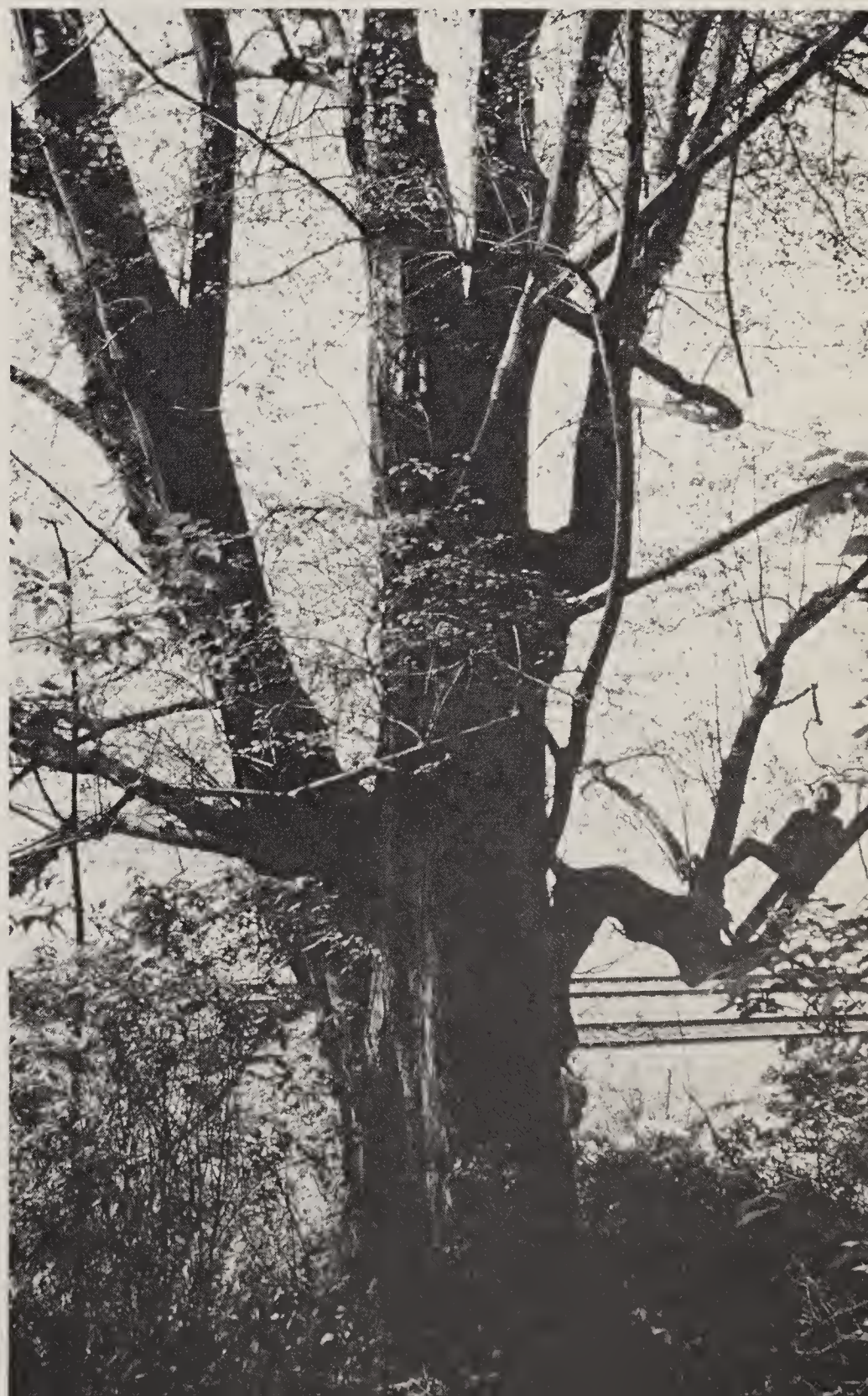
CARKEEK PARK, in northwestern Seattle, has strikingly beautiful woods, both deciduous and evergreen. The loggers left a few maples, and one such tree qualifies as having the thickest trunk of any tree in Seattle. Several mammoth forks arise from its basal trunk of about 30 feet in circumference! The tree is perched on the edge of a nearly vertical hillside above the field for model airplanes.

O.O. DENNY PARK is a Seattle city park that happens to be on the east side of Lake Washington, about one mile south of St. Edward's State Park, in Juanita. This little-known park is significant for a Douglas fir which is not merely the biggest tree in Seattle, but possibly in King County. A plaque at the base of the trunk gives the height at 255 feet, age nearly 600 years, and trunk circumference almost 27 feet. To see this giant you must follow a muddy trail up a wild ravine, where big birds of prey such as hawks and eagles are seen, some nesting. It is worth visiting!

Tales of Tall Trees

How many cities the size of Seattle have trees over 250 feet tall? Since nature has forested the Pacific Northwest with unusually tall conifers, perhaps we take for granted our giant trees—trees far bigger than most people elsewhere have. Of only sixteen kinds of trees in North America which have been known to attain 250 feet or more, all but two (eastern white pine and giant sequoia, the big tree) are native to Washington or Oregon. Previously,

This red alder, nearly five feet in trunk diameter, can be found near the railroad tracks at the north end of Golden Gardens Park. **Photo: G. Ferber**



A black cottonwood *(Populus trichocarpa)* in Boren Park, towering over a thicket of alders and maples (page 16). Photo: G. Ferber

the tallest tree known in Europe was a Norway spruce 215 feet tall; now the tallest is an imported Douglas fir nearing 200 feet![2]

So the Pacific Northwest is indeed singled out. Beyond doubt no other region's conifers can match ours. Nor do we lack in record-breaking tall broadleaf trees, since our black cottonwood (*Populus trichocarpa*) has been scaled at 225 feet—taller than any other deciduous tree recorded.[3] Why is the area blessed with so many unusually tall trees? Conducive environmental conditions provide a reasonable answer: the maritime climate brings ample warmth, moisture and cloud cover; the monumental action of glaciers and volcanoes has created a very hilly terrain with valleys which protect trees from blasting wind, allowing for luxuriant growth. The combination of sufficient moisture, comparatively mild winters and glacial soil has ensured the supremacy of conifers in the Pacific Northwest. Not only the native trees, but also most introduced ones grow well given these conditions.

Seattle is particularly rich in trees first because it has a good climate, then because not all of its old-growth was logged, and finally because it has an enviable and diverse park system. For many who appreciate and admire trees, a 600-foot skyscraper or Space Needle is no more impressive than a tree over 100 feet in height, in which the city abounds. Few structures in Seattle today can match the centuries-old trees in age. Throughout the city are great trees, some in the parks we have discussed, some in other parks and places. As Thoreau wrote about his vicinity, we can today observe for Seattle:

> ". . . I see that all is not garden and cultivated field and crops, that there are square rods in Middlesex County as purely primitive and wild as they were a thousand years ago, which have escaped the plow and the axe and the scythe and the cranberry-rake, little oases of wildness in the desert of our civilization, wild as a square rod on the moon . . ."
>
> August 30, 1856

The accompanying photographs hint at this natural heritage in the Emerald City, but to fully appreciate their magnificence we must turn to the trees as they are, in the parks all around us.

ADDRESSES OF THE PARKS

Schmitz Preserve Park: Admiral Way S.W. and S.W. Stevens
Lincoln Park: Fauntleroy S.W. and S.W. Webster
Seward Park: Lake Washington Blvd. S. and S. Juneau
Martha Washington Park: 6612-57th Ave. S.
Leschi Park: Lakeside S. between Blaine Blvd. and Leschi Pl.
Washington Park Arboretum: E. Madison and Lake Washington Blvd. E.
Boren/Interlaken Park: Interlaken from Lake Washington Blvd. E. to E. Roanoke
Discovery Park: 36th W. and W. Government Way
Golden Gardens Park: the north end of Seaview N.W.
Carkeek Park: N.W. 110th, off of N. Greenwood
O.O. Denny Park: 12032 Holmes Pt. Dr., Kirkland

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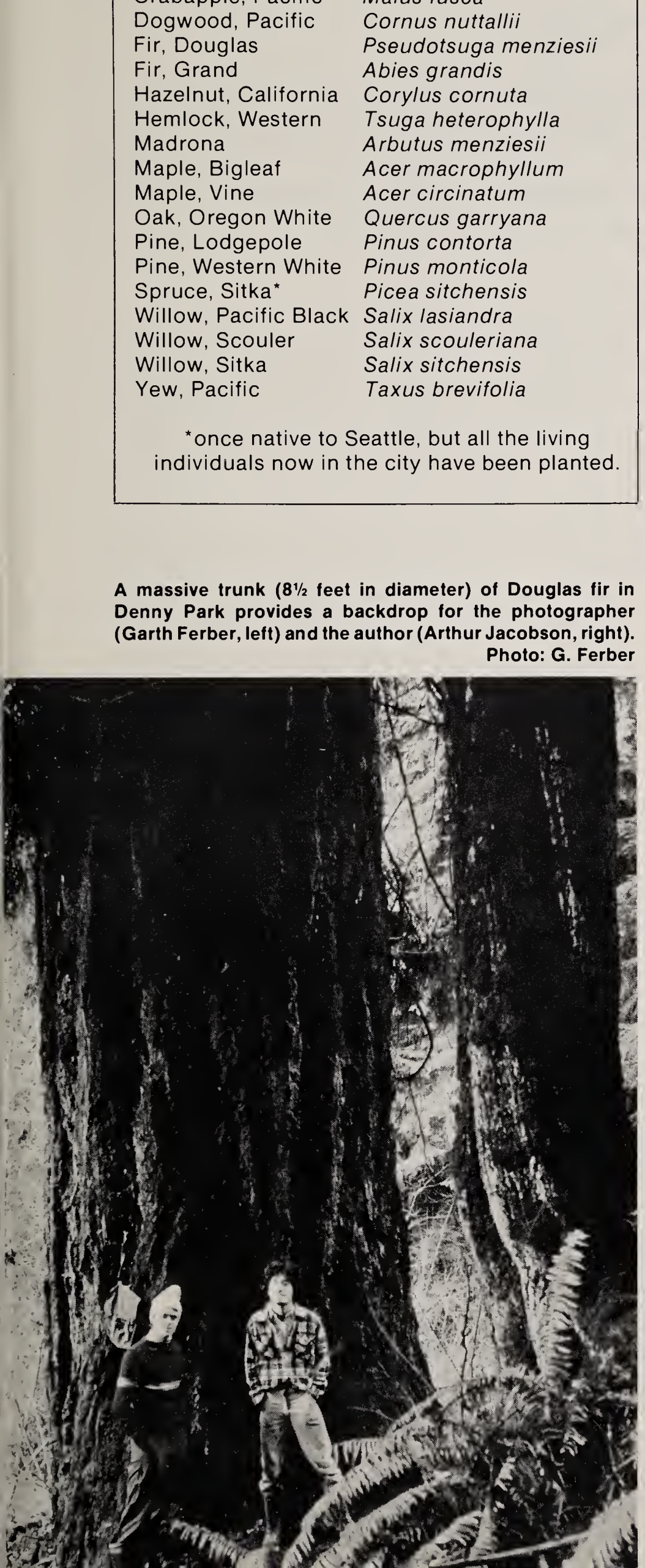
[2]The latest information shows that this size is equalled by the grand firs in Scotland; *see* Mitchell, Alan, International Dendrology Society Yearbook, 1980, p. 128.

[3]Collingwood, G.H. and W.D. Brush, revised and enlarged by D. Butcher, 1979. Knowing Your Trees. American Forestry Association.

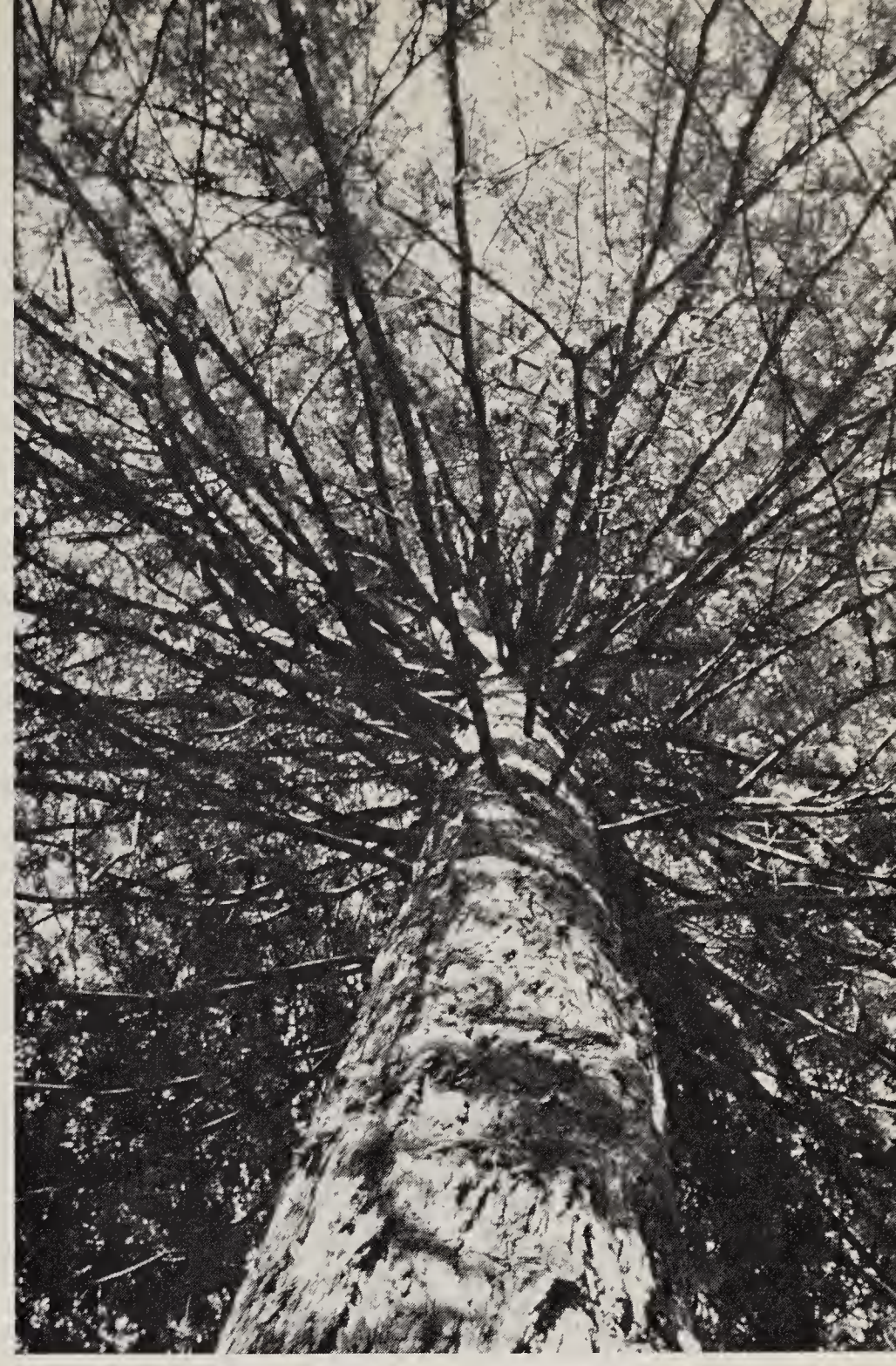
NATIVE TREES CURRENTLY WILD WITHIN THE CITY LIMITS OF SEATTLE

Alder, Red	*Alnus rubra*
Ash, Oregon	*Fraxinus latifolia*
Cascara	*Rhamnus purshiana*
Cedar, Western Red	*Thuja plicata*
Cherry, Bitter	*Prunus emarginata*
Cottonwood, Black	*Populus trichocarpa*
Crabapple, Pacific	*Malus fusca*
Dogwood, Pacific	*Cornus nuttallii*
Fir, Douglas	*Pseudotsuga menziesii*
Fir, Grand	*Abies grandis*
Hazelnut, California	*Corylus cornuta*
Hemlock, Western	*Tsuga heterophylla*
Madrona	*Arbutus menziesii*
Maple, Bigleaf	*Acer macrophyllum*
Maple, Vine	*Acer circinatum*
Oak, Oregon White	*Quercus garryana*
Pine, Lodgepole	*Pinus contorta*
Pine, Western White	*Pinus monticola*
Spruce, Sitka*	*Picea sitchensis*
Willow, Pacific Black	*Salix lasiandra*
Willow, Scouler	*Salix scouleriana*
Willow, Sitka	*Salix sitchensis*
Yew, Pacific	*Taxus brevifolia*

*once native to Seattle, but all the living individuals now in the city have been planted.



A massive trunk (8½ feet in diameter) of Douglas fir in Denny Park provides a backdrop for the photographer (Garth Ferber, left) and the author (Arthur Jacobson, right).
Photo: G. Ferber



Gazing into the canopy of the tallest redwood *(Sequoia sempervirens)* in Seattle, in Interlaken Park. At 130 feet tall, this tree is probably 75 years old (page 17).
Photo: G. Ferber

NON-NATIVE TREES NATURALIZED ON A LARGE SCALE

Apple	*Malus pumila*
Birch, European White	*Betula pendula*
Cherry, Mazzard	*Prunus avium*
*Elm, English	*Ulmus procera*
Goldenchain	*Laburnum anagyroides*
Hawthorn, Common	*Crataegus monogyna*
Holly, English	*Ilex aquifolium*
Hornbeam, European	*Carpinus betulus*
Horsechestnut	*Aesculus hippocastanum*
Laurel, Cherry	*Prunus laurocerasus*
Laurel, Portugal	*Prunus lusitanica*
*Locust, Black	*Robinia pseudoacacia*
Maple, Norway	*Acer platanoides*
Mountain ash, European	*Sorbus aucuparia*
Oak, English	*Quercus robur*
Plum	*Prunus domestica*
*Poplar, Lombardy	*Populus nigra* 'Italica'
*Poplar, White	*Populus alba*
Tree of Heaven	*Ailanthus altissima*
Yew, English	*Taxus baccata*

*reproducing only by root suckers

Landslide!

— and Repair

JAN PIRZIO-BIROLI

Editor's Note: Just as the repair of this landslide was a cooperative venture, so too was the writing of this article. While Jan Pirzio-Biroli arranged the material, the story itself is truly the work of the owners of the landslide property. The story is of particular interest during this, the wet season of a wet year. The plan of restoration used for this property might serve as a model for the rehabilitation of other such properties.

The Pacific Northwest is famous for its steep, wooded ravines and for its hilltops yielding vistas of mountains and water, sunsets and dramatic storms. These hills, carved by glacial invasions and covered by glacial till, are prime residential view properties. However, because of their structure—alternating layers of impermeable clay and soft, sandy soil—they can be treacherous building sites, especially prone to earth slides when they have been drenched by months of rain.

In certain areas around Seattle, washouts have become a common occurrence. Specific curves on Mercer Island roads and sites on cliffs along Puget Sound, for example, can be expected to become eroded every few years. A simplistic explanation is that the underlying layer of clay becomes wet and slippery, causing the softer soil that lies on top of it to slide away.

Emergency measures at the top of the slide: "...a temporary plastic covering to stop what's left from leaving. . .held down with everything and anything handy."

Around the first of the year in 1972, a deep layer of snow lay on the ground for two weeks—a most unusual occurrence in Seattle, where our snows usually last at most one or two days (if the school children are lucky!). In late February and early March, after the snow had melted and seeped into the ground, Seattle was inundated by continuous rainstorms for another two weeks. The water that had accumulated in the soil caused so many slides that several counties in the Puget Sound region were proclaimed a national disaster area. The following story describes what happened to one property, and what steps were taken to restore it and to prevent repetitions of the serious slide that had occurred. In many respects, this is a positive tale; the problem was approached with the utmost care, and experts were consulted in the creation of a solution.

The Slide

On Sunday, March 5th, it was still pouring. The owner was alone in the house at about 6 PM when she heard the sound of a gravel truck dumping its load—a strange time and place for such a delivery since the sound came from

her steep hillside garden which had no access by road. She went to the door to find out what it was all about, only to find herself staring into a void where part of her garden had been. An instant slide had removed the top layer of the hillside—plants, grass and soil had all flowed down into the valley below, leaving a 60- by 200-foot ugly, muddy scar. Neighbors and the local hardware store rushed to her rescue. The owner opened his store on Sunday and sold them all his heavy-gauge plastic. These huge rolls were hastily spread and secured over the top of the slide to keep the pelting rains from causing any further damage.

Fortunately this was an architect-designed house, built with full consideration for the peculiarities of the site. Because the possibility of slides had been anticipated, the vulnerable corner of the house nearest the steep hillside had been pinned deeply into the hard glacial till (the "hardpan") and strengthened with additional reinforcing rods. Although the hillside garden northwest of the house had become a sea of quivering, gelatinous mud with areas of 45° slope, just as the building had survived the 1965 earthquake without a single crack, it now remained intact.

Fortunately, also, the entire slide occurred within the boundaries of the property. Hence, there was no damage to surrounding structures, for there were none! The challenge, then, was to stabilize the hillside and in addition, to create a positive visual statement from a negative situation.[1]

Rebuilding

The soils engineer, structural engineer and architect cooperated in planning the restoration. Three concrete retaining walls were designed and placed in strategic areas on the steep hillside. The upper two walls near the house form the foundation for a system of broad wooden decks and stairs to complement the decks already existing on the home's main floor. From the living room, sliding doors open onto the original upper decks, which are connected by stairs and lawn to the two new lower decks. In fine weather, these greatly expand the capability for entertaining large groups. The deck railings were built to hold planter boxes, which spill over in summer with colorful annuals. Beneath the new decks the soil was covered with heavy-gauge plastic to insure that no moisture could be absorbed to build up subsurface pressure again.

Terracing on the slope was achieved with "W" rails—steel freeway safety barriers—that are cheaper, wider, stronger and more permanent than railroad ties. They were anchored into the "hardpan" with steel posts. Railroad ties were used to form steps on the path leading down the hillside garden.

The final design is a combination of architecturally exciting support for the house and a jungle of plant material below on the steep but now secure and accessible hillside.

The Plantings

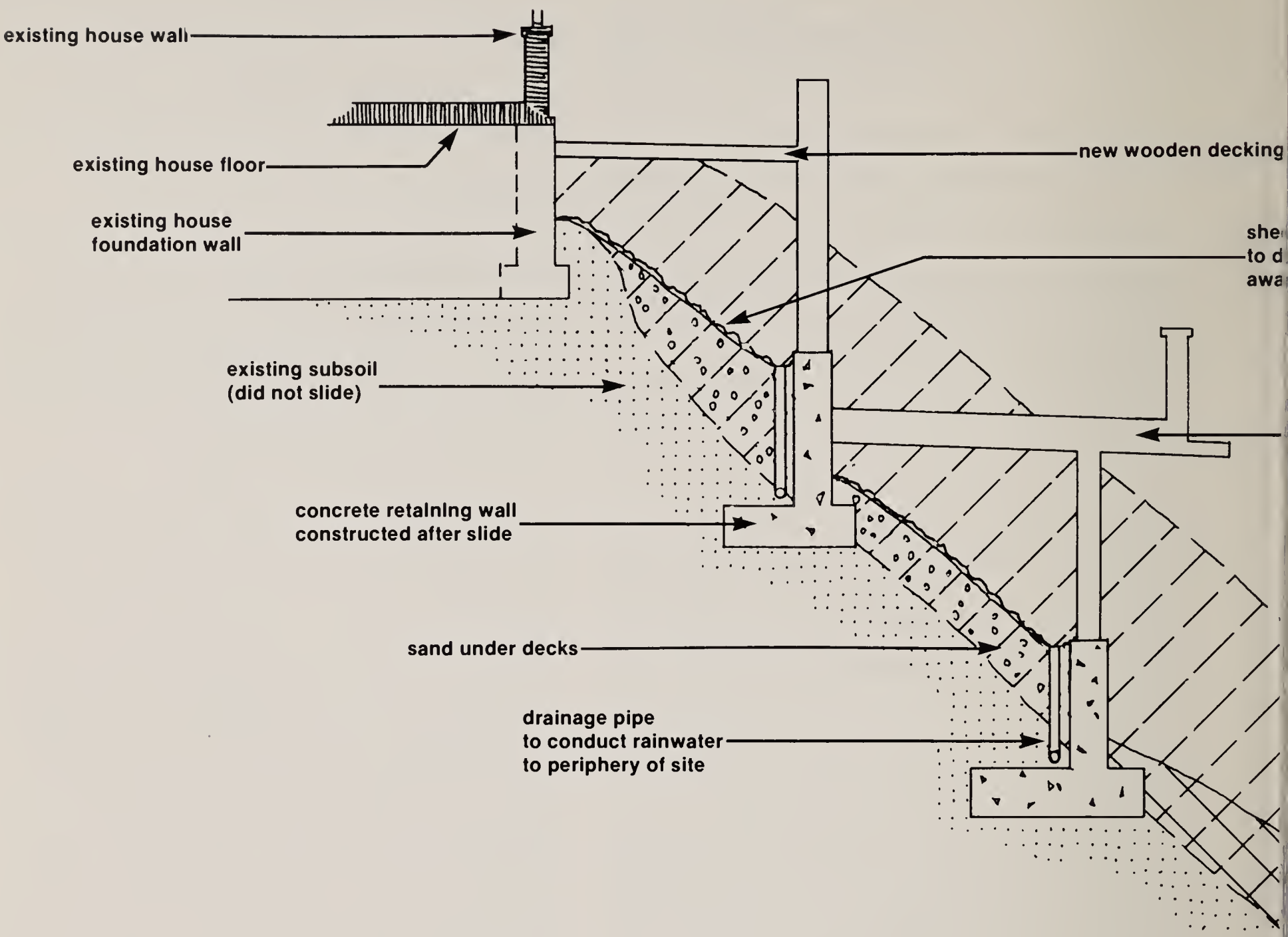
The soils expert recommended that the deepest rooted plants be used in abundance, plants such as the fast-growing and invasive *Hypericum calycinum,* which can become a scourge in gardens. This is used, but with restraint. The owner, a dedicated gardener, could not live with an area above the lowest retaining wall 60 feet wide and 100 feet long covered only with St. John's wort. Instead a multitude of other plant material has been incorporated into the scheme.

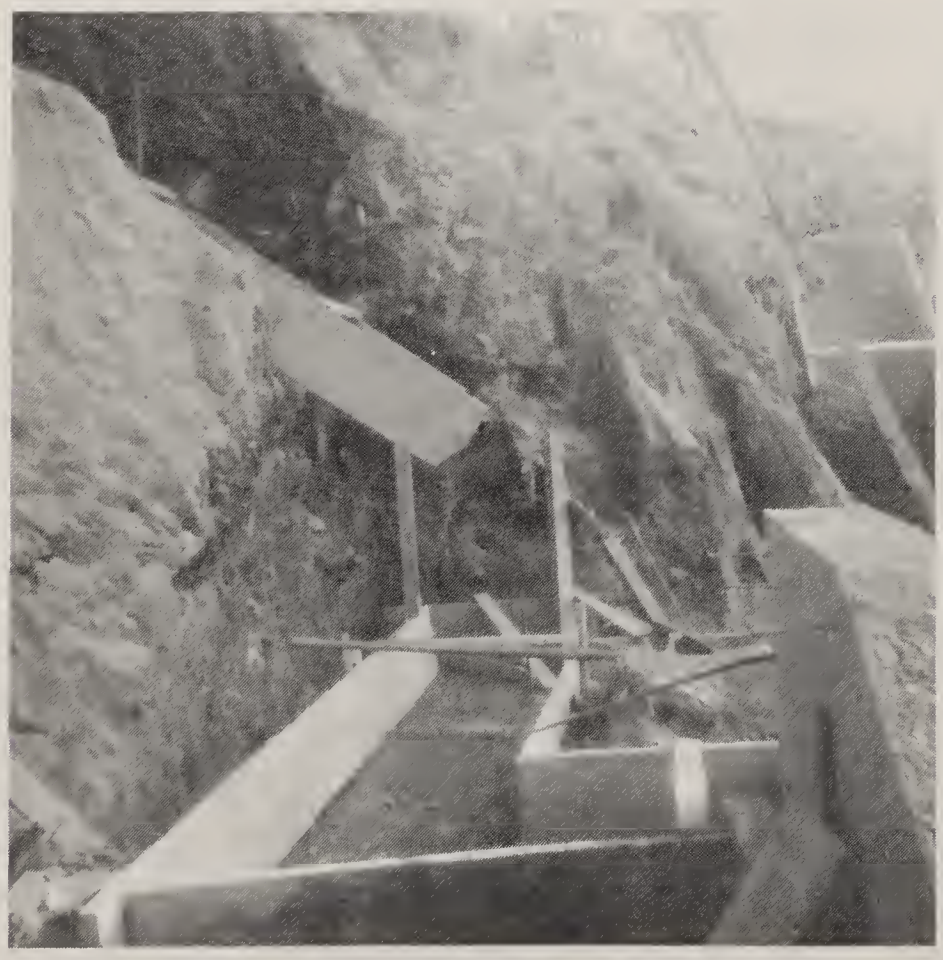
The owner will always be grateful to certain large plants that stabilized the sides of the slide. These were a native hazelnut (*Corylus cornuta*) and a *Rhododendron ponticum* (whose leaves were covered with mysterious yellow spots the next year); across from them a pink-flowered *Weigela* and a tall deciduous *Cotoneaster* remained on the brink of the slide. In contrast, a plant of the rare, white-flowered *Magnolia heptapeta (denudata)*, the Yulan magnolia, slid upright 200 feet to the bottom of the hill and remained standing. It was left in place and flourishes today in this beautiful site.

Except for these plants, all others were added with consideration for the soils engineer's instructions. Hence, regrettably, no other rhododendrons could be used, because their roots are relatively shallow. An important

[1]Financial stress was alleviated by a low-interest federal disaster loan made available to victims in federally-declared disaster areas. Protection against possible future slide disasters is insured by the National Flood Insurance Program, which all recipients of disaster loans must carry.

REPAIR PLAN FOR

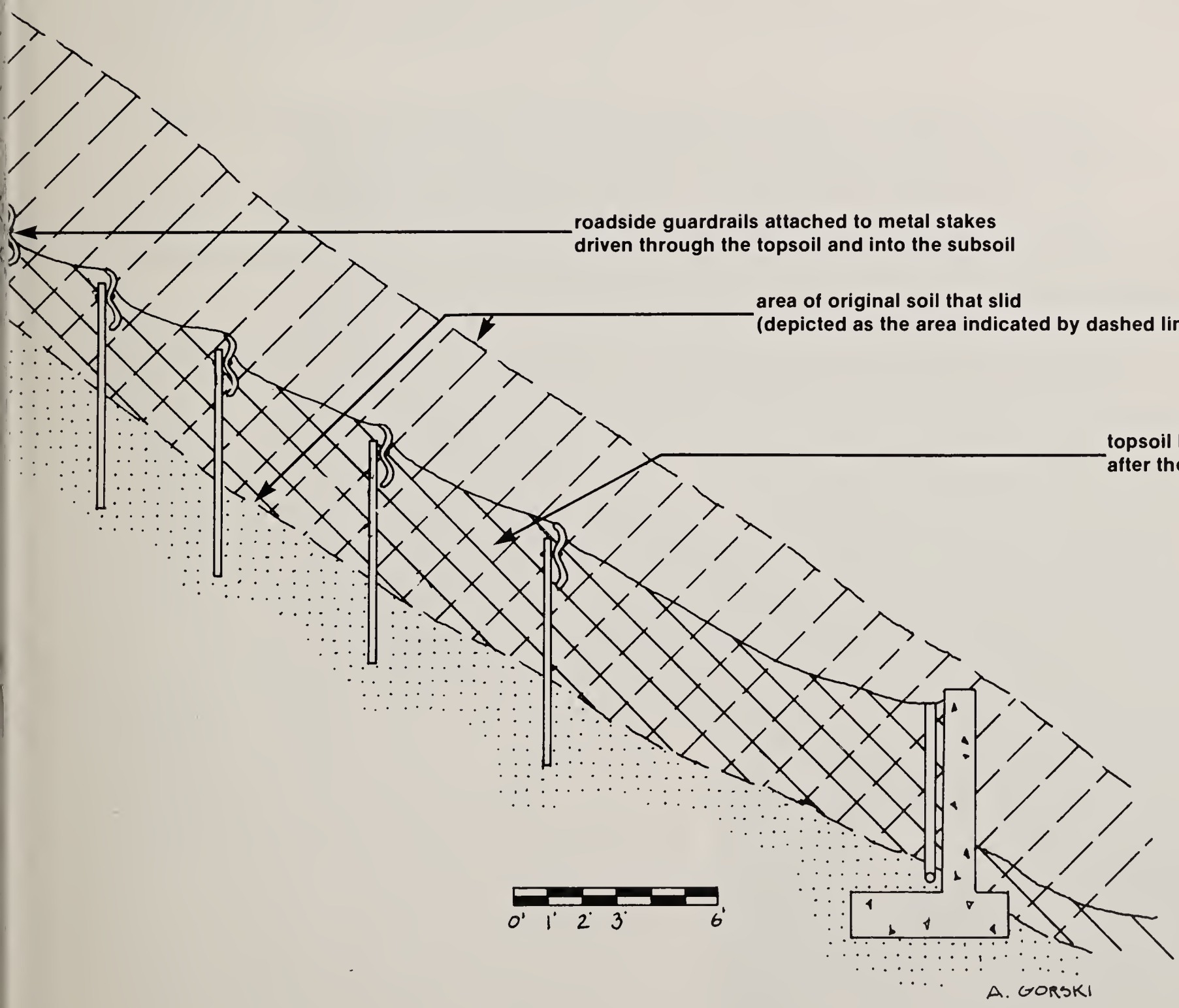




Reconstruction: building the retaining walls.

ANDSLIDE DAMAGE

A view of the landslide property showing the house at the edge, the upper part of the slide protected by plastic, and the trees and shrubbery stabilizing the sides of the slide (page 21).



factor in determining the choice of plant materials was foliage texture and contrast, especially when viewed from above.

More practical considerations included good bargains and welcome donations from friends. Truckloads of plants were hauled away from overgrown gardens. Some plants potentially so large that most of us can afford to give room to only one, if any, were purchased in lots of six. The luxuriance of plant material is impressive, enviable to those of us who have never experienced the need to fill a void rapidly.

At the top of the slope several varieties of flowering quince (*Chaenomeles*) soon became a tangled, deep-rooted thicket. These were nameless bargains; most of them are red, but there is one with beautiful, double salmon-colored flowers. The *Weigela*, which gives summer color, is underplanted with low-growing evergreens—*Euonymus fortunei* var. *radicans*, species of *Sarcococca*, and rose-berried *Pernettya mucronata*. *Abelia* x *grandiflora* is beautiful throughout the year. Below the decks but growing tall enough to hide the plastic beneath them are the evergreen *Skimmia japonica*, *Aucuba japonica* (the gold dust plant) and *Choisya ternata*, Mexican orange. Growing up through this evergreen background are taller plants such as witchhazel (*Hamamelis japonica*), seedlings of the golden chain tree (*Laburnum anagyroides*) from a friend's garden and *Stranvaesia davidiana*, which provide additional color at various times of the year.

Aerial view of the lower deck, with planter boxes at the far end. The steps (foreground) lead to lawn and thence to the upper decks. **Photo: J. Pirzio-Biroli**

The main slope is filled with a tangle of the following plants:

Forsythia—several large plants that give masses of yellow in late winter

Elaeagnus pungens 'Variegata'—yellow-margined leaves complement the forsythias

Rhus typhina, staghorn sumac—a good plant to view from above with its spreading rosettes of soft, colorful leaves

Viburnum carlesii—fragrant inflorescences and beautiful, soft, deciduous leaves with deeply impressed veins

Hamamelis seedlings—from *H. virginiana*, *H. japonica*, and *H. mollis*, presenting a range of bloom time from late fall through early spring

Viburnum davidii—with strong-textured evergreen leaves

Cotinus coggygria, smoke bush—for leaf color contrast

Parrotia persica—a small tree with brilliant golden color in autumn

Davidia involucrata, the dove tree—large white bracts arranged to resemble that lovely bird

There are various cotoneasters, and the birds have added others. These (mostly) red-berried shrubs give cheerful color in winter, and provide food for colorful birds. Some native dogwoods and numerous alders have invaded the slope; these latter are the only plants that are systematically weeded out.

Holding the base of the slope is an eight-foot concrete wall with an extensive drainage system behind it. This is covered with a delicate ivy that began with cuttings from a generous friend. Below the wall are several more large *Hamamelis* seedlings and another smoke bush. In addition there are:

Cercidiphyllum japonicum—an elegant branching pattern and neatly arranged paired leaves, which have beautiful color in spring and fall

Euonymus species—offering excellent fall foliage and fruit in addition to their good, deep roots

Pyracantha coccinea—another bright-berried evergreen plant

Viburnum opulus, the highbush cranberry—lace-cap inflorescences in spring and maroon foliage in fall, offsetting the glowing red fruits

Viburnum cinnamomifolium—a larger version of *V. davidii* but with shiny leaves, hence better seen from a distance, although the owner likes it so well she wishes she had planted in farther up the hill

Viburnum rhytidophyllum, leatherleaf viburnum—three of these ultimately immense shrubs!

Cotoneaster species—so graceful where there is space for them to grow naturally.

In the damp soil at the base of the hill there are French pussy willows and great, soft masses of horsetails that the owner can enjoy because they are not crowding other, more valuable plants.

The local mountain beavers (*Aplodontia rufa*) have readily adapted to the exotic new foliage, obviously preferring it to their more mundane diet of salal and Oregon grape, but the plants seem to be surviving such enthusiastic pruning. No other pruning will be attempted by the owner, except along the paths. The plants must fill their own space, and only the most vigorous will survive.

It has been more than ten years since the slide occurred, and the hillside is stabilized. The garden grows as it is intended to, the roots of numerous plants tying the soil to the layers beneath. When one looks down from the decks above, one admires the various tones of green, and the bright foliage and fruit in autumn; flowers in spring and summer are also a delight. When one penetrates the wild, one wonders how so much can have grown in such a brief time.

Luxuriant vegetation now shelters both the upper and lower decks of the landslide property. **Photo: J. Pirzio-Biroli**

Update on the Camellia Collection

*SANDY BRIGGS**

Along Arboretum Drive there have been a few changes in the past year. Most dramatic is the appearance of the new bed on the west side of the road just north of the hollies. The Camellia Project began in February of 1982, and has occupied two gardeners throughout the spring and fall, with periodic help from the rest of the crew.

The first *Camellia* beds in the Arboretum were planted shortly after World War II, with many of the original plants acquired between 1939 and 1944. In the mid-50's, another batch was acquired and planted alongside the others, probably to compensate for losses. Since then, the camellias have done a lot of growing. Plants that had enough space in the '60s were being choked out by 1980. In other places, the demise of one or more plants left small clearings.

The Camellia Project was designed to ameliorate this situation. A score of plants was moved within the beds to even out the spacing, and a new bed was created to take nearly a hundred more, although many of these came from the nursery. A number of duplicate plants and wild seedlings were removed. There are still enough camellias both in the beds and in the lath houses and nursery to fill another bed; by the time this is printed there will be a new bed on the east side of the drive. In addition, the plants were pruned extensively since some of the aforementioned growth needed curbing. Many camellias had grown together into a hedgelike mass, or in their thick growth were shading themselves too much.

The Techniques We Used

Camellias like partial shade, good drainage and plenty of water, so we have had a few obstacles to overcome whilst planting. The first bed was cleared on a hillside with clayey soil. We dug two drainage ditches, amended the soil thoroughly with compost and regraded the slope. The automatic sprinkler system was extended to cover the bed for watering, and we needle-watered the roots directly until the sprinkler system was available. After planting, we mulched with woodchips to reduce runoff as well as to add nutrients to the soil. The second bed, luckily, is on level ground and has a sandy soil. Here we again have amended the soil with compost, and will mulch after planting, but obviously drainage will be much less of a problem. In the actual planting, we found ourselves following the roots and coming up with large, deep rootballs. All the larger plants were balled and burlapped, and required a tractor to be moved.

After most of the planting had been done, we began pruning. The most common problem was overly thick foliage, with many branches crossing, and the lowest branches shaded out. We tried to avoid situations which would encourage water sprouts by removing whole branches rather than cutting back each twig. Removing the crossing branches usually opened up the plant and let in enough light. In situations where plants too near each other were intergrown into a hedge, we cut back enough to renew the appearance of separate plants. Occasionally there were camellias with leggy branches, especially near the top. Cutting the leaders back increased bushiness in those cases.

The gardeners involved solely in the Camellia Project were Sandy Briggs, Charmaine Adsero, Ron Brightman and David Zuckerman.

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*Arboretum Gardener

Adult whiteflies, 1/10 to 1/16 inch long, are covered with a white powdery wax. Both adults and nymphs damage plants by sucking plant juices. Photo: Roger D. Akre, Department of Entomology, Washington State University

Biological Pest Management— An Introduction

*DAVE MIRGON**

Biological pest control is becoming a more and more attractive method for controlling insects as pesticide costs continue to climb, and as the public becomes more interested in reducing the use of pesticides.

Biological control methods are now being used in many parts of the world including Holland, England, Canada and the USSR, and in many parts of the United States, particularly in California and Hawaii. The importance of biological control becomes even more apparent as we become aware of accidents with pesticides such as the recent Hawaiian milk accident when milk and ice cream were recalled. (Pesticides entered the food chain as the result of pineapple leaves that had been treated with pesticides being chopped up for cattle food. The pesticide persisted in the milk).

Biological control programs include the use of predators, parasites, and pathogens in the control of insect pests. Predators actually catch and devour their prey, while adult parasites deposit eggs in or on eggs of an insect pest. The parasite eggs hatch inside the pest egg and eat the pest from within. Pathogens cause the insect pest to become sick and die. Pathogens are disease-causing organisms

*Dave Mirgon, a graduate of George Fox College and of the University of Washington, is a licensed Commercial Pest Control Consultant.

Eggs of the whitefly—a semicircle of small ovals attached to the host leaf by a stalk. Photo: Roger D. Akre

that in some instances cause the insect to cease eating, and thus die of starvation.

We do not know for how long predators have been used in the control of insects. We do know that the ancient Chinese used ants (*Oecophylla smaragdins*) to control caterpillars and large boring beetles on citrus trees. These people even built bridges of bamboo strips from tree to tree for the ants to travel on.

Only 223 pest control projects have used the introduction of natural enemies. Of these 223 projects, 120 have been successful (DeBach, 1974). As insect resistance to pesticides develops, more attention probably will be given to biological control. (There are currently approximately 500 species of insects that are known to be resistant to at least one commonly used pesticide.)

The most commonly used predators and parasites in western Washington are lady beetles, scale parasites, lacewings, predatory mites, parasitic wasps *(Encarsia formosa* and *Trichogramma)* and fly parasites. Biological control organisms are closely associated with the pest to be controlled. *Encarsia formosa* feeds only on white fly, predatory mites feed on pest mites, *Hippodamia convergens* (a type of lady beetle) feeds only on aphids, and *Trichogramma* wasps feed on moth and butterfly caterpillars. Biological control organisms also are responsive to the increase or decrease of the pest population.

The praying mantis is well known because of its appearance, and is fun (for some people) to have in the garden or greenhouse, because it has an interesting life cycle. As for biological control, the praying mantis is not as useful as other control insects because it is a general feeder. That is to say, mantids eat just about anything that gets close enough for them to grab. They are not aggressive feeders either, but simply wait until some unfortunate, edible bug comes near. The mantis has only one full generation per year and thus is not as helpful as other predatory insects which reproduce several times in a season.

While the use of biological pest control is becoming increasingly popular, few people have a clear understanding of what is involved in such a program. They will read of a method in a magazine, try it, and often will be disappointed with the results because of their lack of knowledge. Here is an overview of the major considerations to be aware of in biological pest control.

Is there an insect problem? Is there going to be an insect problem? What kind of insects are causing the problem? Your county extension agent or a commercial consultant can help to identify the culprit. However, you do need to catch a specimen to show the extension agent or consultant so that a proper identification can be made.

If it is found that the problem *is* an insect pest, one must determine the severity of the infestation. It is much better to introduce the correct predator or parasite at the first sign of the host pest, than to wait until the infestation becomes too intense to be controlled. By the time a plant is heavily infested with white flies, it is generally lacking in vigor, and may wilt, turn yellow and die. The leaves and fruit will become coated with a sticky secretion called 'honeydew', which is caused by the white fly and which encourages a fungal growth. As a

result, the plant has to be cleaned in addition to killing the white fly, increasing labor costs and the chance of injury to the plant.

With mites, plant damage occurs when the leaf cells are punctured by mites feeding on the plant fluids, causing areas of speckling on the leaves. Some mites produce webbing close to the leaf surface or between the various plant parts. In severe infestations, some species produce enough webbing to cover the entire plant. The threads are much finer than those produced by a spider. Mites are difficult to detect on plants, therefore, hold a white piece of paper beneath the foliage and tap the foliage sharply—if mites are present, some will be jarred from the leaf and can be seen as tiny specks crawling on the paper.

Predatory mites are used to control pest mites on houseplants, vegetables such as beans and cucumbers, fruits such as grapes, strawberries, and apples, as well as roses and many other ornamentals grown outdoors and in greenhouses.

As previously mentioned, the proper predator must be used with each different pest. There are over 300 species of lady beetles used for the control of aphids and other soft-bodied insects. Although many species of the wasp *Trichogramma* are used for the control of caterpillars, some prefer forests, populating tree tops while others prefer vegetable and field crops or ornamentals and orchard crops. The proper species must be used.

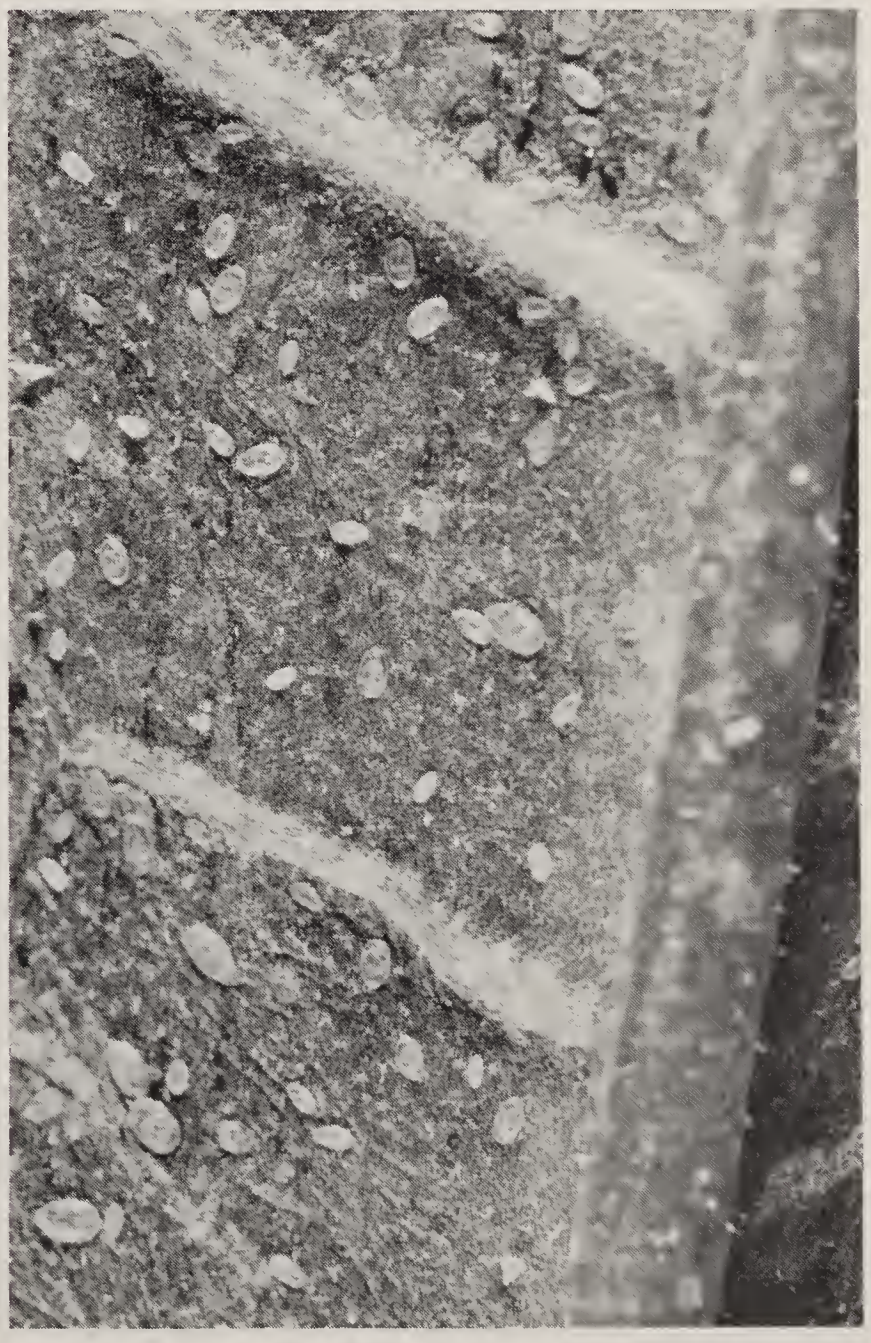
How many predators or parasites are needed for a garden, field or greenhouse? This number is determined by the size of the area that needs to be controlled. Lady beetles in a greenhouse are used at the rate of 1000 per 2000 square feet. In a medium city-lot size garden, 4500 lady beetles or 40,000 *Trichogramma* wasps are released.

Encarsia formosa, the parasitic wasp of white fly, is about 0.6 mm long and has a black head and thorax and a yellow abdomen. Almost all of the adults are females, each female lays one egg in each of 50 to 100 white fly nymphs (scale). The parasite develops inside the scale, turning it black. When fully developed and ready to leave the scale, the new adult parasite chews a hole through the scale, and without mating, begins searching for new white fly scale to parasitize. This complete cycle takes three to four weeks at 70° F. In greenhouses, temperatures must be maintained at 55° F. at night, and must average 75° F. during the day for the parasites to keep the white fly infestations in check. At 64° F., the white fly can reproduce ten times as fast as the parasites, but at 78° F., the two reproduce at the same rate and the parasite matures faster. Thus, the parasite can overcome the insect pest only at the warmer temperature.

Temperature is also important for mites. One female spider mite pest in one month can give rise to 20 offspring at 60° F., 13,000 at 70° F. and 13,000,000 at 80° F. These mites go through three generations in 14 days. The predatory mites reproduce best at temperatures between 70° and 80° F. They lay 50 eggs at a time rather than 20, and pass through three generations in less than a week rather than 14 days. They are thus reproducing faster than the harmful mites and in addition, devouring 5 to 20 pest mites per day. Lower temperatures usually interfere with the reproduction rates of the predatory mites.

Nymphs (pictured below) emerge from whitefly eggs, proceed through several larval stages and a pupal stage, from which adults once again emerge.

Photo: Roger D. Akre



There has been experimentation with the use of pathogens for the control of pests. However, at this time, only the use of the bacterium *Bacillus thuringiensis* (BT) is allowed on edible crops. *Bacillus thuringiensis* Berliner is the organism used to control lepidopterous caterpillars such as tent caterpillar and gypsy moth. Recently, the use of BT Berliner var. *israelensis* has been approved for the control of larvae of 30 different species of mosquito. Also newly approved is the use of BT var. *aizawai* for control of wax moth larvae in bee hives that have insufficient bees to cover the combs stored at moderate or warm temperature.

If several details are taken into consideration, a gardener should be able to use BT successfully. The timing of the application is important. It should be used at the first sign of caterpillars, when they are still quite small. Young caterpillars are feeding voraciously to accommodate their rapid growth rate, and it is these youngsters that do most of the damage to the plant. The gut juices of the actively feeding caterpillars activate the BT bacterium and the bacterium in turn causes the larva to stop eating, and thus to die. Older caterpillars are no longer actively feeding, and their death would not prevent immediate damage to the plant. In addition, they might not consume much of the BT bacterium, nor would the BT be likely to be activated. Older caterpillars are moving out, seeking a place to form a cocoon. It would be well to destroy them before they lay eggs that will overwinter.

Bacillus thuringiensis is available in liquid and powdered form, both of which must be mixed into water. Old BT should not be used, nor should BT be allowed to freeze, or allowed to get warmer than 90° F. The bacteria die under those conditions. The water for dilution of the BT should not be alkaline, or the bacteria will be activated before they reach the insect pest. Unless you have equipment to test pH, it seems reasonable to add a tablespoon or two of vinegar to the dilution water to insure against excess alkalinity.

Research is currently underway in Europe to determine which parasites and predators function well in moderate temperatures such as we enjoy in the Pacific Northwest. The results of this research will be a benefit to our continued efforts of biological pest management.

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from WHITE, FALLING

. . .In the hour turning at the Equinox, the ptarmigan
begins to molt her winter feathers, she and the tundra
softening into stippled brown. . .

Melinda Mueller

from *PRIVATE GALLERY,* The Seal Press, Seattle

Lake Clark, north of Lake Iliamna, is forty miles long; the Chulitna River flows into the lake at the left. The Hornbergers' home and airstrip are visible in the center of this photograph. Photo: S. Hornberger

Gardening in Alaska

*SARA HORNBERGER**

Gardening in Alaska can be successful and rewarding when the gardener recognizes and compensates for the special conditions imposed by geographic location and climate. Our early years of gardening on the upper portion of the Alaska Peninsula, first in Naknek on Bristol Bay and later in our present location on Lake Clark, were disappointing because we gardened the same way we had so successfully in other states. When we at last realized that we were dealing with a unique situation requiring unique gardening methods, we began to experience success. Today we grow about seventy-five per cent of the vegetables we eat.

Alaska is a big, diverse state and climatic conditions vary greatly from one portion of the state to another. The major problems we contend with on the peninsula are short growing seasons with frost danger during periods of the full moon in the summer; perpetually cold soil; cool summer temperatures that may average as low as 52° F.; many more overcast days than clear; frequent strong, desiccating winds; and days and weeks of cold rain alter-

*Sara and Chuck Hornberger, who settled in Alaska in the early 1960's, have lived year-round at their lodge on Lake Clark since 1974.

nating with long periods of no rain. One other serious problem is root damage to perennials in the winter months caused by deep freezing of unprotected soil, frost heave, and glaciering when warm spells bring rain on hard frozen soil. It is the latter problem that prevents our protecting perennials with mulch covers.

The sensible gardener in a new location looks to neighbors for gardening advice. Others, such as we, learn through hard experience and waste money and time on seeds and plants that have no chance of growing or fruiting. Over the years, we have finally accepted that we cannot grow corn, beans, tomatoes, peppers, egg plants, and cucumbers in the garden. We are still trying to grow winter squash. Greenhouse space is limited, so we use it for tomatoes, cucumbers, and peppers. After years of experimentation, the only fruits we've grown successfully are chokecherries, red raspberries (and we run a contest with the frost every year for our crop), black currants and rhubarb. We keep trying strawberries, but many winters the plants freeze and our crops are usually meager. (We did learn this summer that the meager crops may be due to zealous harvesting of the ripe berries by foxes.)

The vegetable crops we grow successfully in the garden are potatoes, turnips, rutabagas, cabbages, broccoli, cauliflower, kohlrabi, greens of all sorts, radishes, beets, carrots, peas, and the herbs: dill, thyme, marjoram, and sage. We started by using varieties recommended for Alaska by the University Extension Service and the Agricultural Research Farm in Palmer. Each year we experiment with several new varieties of the above vegetables seeking those best suited to our particular gardening spot. Several we have found that work best for us are Queen Crown and Ithaca lettuce from Vesey's, Burpee's golden beets and Fordhook Giant swiss chard, Premium Crop broccoli, and Alaska Early peas. In the greenhouse, we have for some years grown only Vendor tomatoes from Stokes and Burpless cucumbers from Burpee's. These two varieties do so well, experimentation seems pointless.

What are the things we have done to achieve gardening success in this difficult location? Fortunately, the location of our present garden gives it a lot of protection from the wind and also presents it to the sun in the most advantageous way. We are on a southeast-facing slope with trees strategically placed (by na-

Vegetables and flowers are planted in profusion in front of the cabins facing Lake Clark. **Photo: S. Hornberger**

ture) that break most of the wind. Were it not for this, we would have to provide shelter using buildings, tight fences and trees, or build to take advantage of natural land formations.

To compensate for our short growing season, nearly everything is started in the house and greenhouse. The only things we seed directly into the garden are peas, beets, carrots, radishes, swiss chard, kale, turnips, rutabagas, and potatoes. Before planting the peas, beets, chard, and radishes, I sprout the seeds. Only in very unusually warm springs do we ever put anything out in the garden (except potatoes) before the first week in June. Before that time, the soil is too cold for anything to grow.

There is no way we can protect the whole garden from cold rains. Through use of healthy, sturdy plants, and careful watering and proper fertilization of the soil early in the year, we try to have plants that can endure the cold wet. Head lettuce and zucchini are damaged the most by these conditions.

To obtain warmer soil for our garden plants, we use raised beds. Last spring we went a step further by removing all the soil from two raised beds, laying two-inch sheets of polystyrene on the subsoil, and then refilling the beds with soil. One summer's use is not enough to determine just how much difference this extra protection from the cold subsoil will make. If, in the next year or two, we see a substantial improvement in production from those beds, we will so modify more of the beds. This summer we will be using some coldframes and cones constructed in our continuing effort to obtain suitable growing conditions for winter squash. We have for some years successfully grown zucchini squash in a coldframe.

Acid soils, popularly reported to be a great problem for Alaskan gardeners, have not troubled us. We use wood ashes extensively in our compost and we throw them out on the gardens in March and April to hasten thawing (the color helps absorb heat from the sun). Our soil, consequently, has not needed lime.

One great advantage we have is that our only garden pest so far is the cabbage root worm. Previously we often lost between one-fourth and one-half of our cole crops (cabbage relatives), especially cauliflower, and it was difficult to find an edible radish or turnip. We have eliminated this pest from our garden and for the past four or five years have lost nothing other than an occasional radish. We accomplished this by mixing wood ashes in the soil and interplanting marigolds throughout the whole garden.

Flowers of all kinds, wild and domestic, are an important part of our garden. Each year we try one or two new annuals. So far, the only one that is not successful is the zinnia. Bachelors' buttons, sweet william, English daisies, blue *Linum,* and borage reseed themselves each year and we no longer have to start them indoors. There are a few perennials, sweet william, delphiniums, *Gaillardia* and columbine, that will live over most winters. The Iceland poppy, introduced years ago, has become a "native." It is the first domesticated flower to come up and bloom in the spring and the last to die in the fall, and it fills the garden with color and fragrance all summer. Many kinds of wild flowers grow in the beds with our tame flowers: yellow and purple violets, coltsfoot *(Petasites sp.),* tundra rose *(Potentilla fruticosa),* pale *Corydalis,* white and red burnet *(Sanguisorba spp.),* wild flag *(Iris setosa),* and marsh marigolds.

Ours is a fragrant, as well as colorful, garden. In May the chokecherries (a variety of *Prunus virginiana)* bloom, filling the air with their sweet spicy fragrance. Shortly after, the cottonwoods and northern bedstraw *(Galium sp.)* combine fragrances to seduce us from work with their heady aromas. The wild roses precede the garden flowers: pansies, sweet william, poppies, sweet peas, stock, babies' breath, and more. It is often difficult to leave the garden with its beauty of color and fragrance.

In retrospect, we do not believe gardening in Alaska is more difficult than in other places. With our lack of garden pests, it may be easier. It is true that we cannot grow corn and beans and we miss them. However, no matter where one gardens there are specific crops that do not thrive. The keys to successful gardening would seem to be adaptation to local conditions, profiting from the successes of others, and acceptance of the limitations imposed by location and climate.

The Conifer Meadow

*ERIC W. HOYTE**

Conifer Meadow area before the beginning of construction, August 1980. Photo: J.A. Witt

Once in a while, the Arboretum gains a little ground, both literally and figuratively. When land was lost to the Evergreen Point Bridge and its approaches in the early 1960's, a portion of the block to the south of the intersection was acquired, cleared of residences and excavated, together with some Arboretum land, into what became known as the Montlake Pit. This was to have been the start of the R.H. Thomson Expressway, but instead became by turns, a waste land for dirt bikes, a planting ground on Earth Day, and a Peapatch.

After construction of the Evergreen Point Bridge and the interchange, over a period of time, the plans for the R.H. Thomson Expressway were finally retired and the property became available for other uses. Offered to the original owners, it was eventually acquired by the Park Department as an extension of the Arboretum. In their Master Plan Update of 1978, Jones and Jones named it Conifer Meadow and described it as an area to be planted with low evergreens and conifers. It was envisioned as an extension of the Pinetum and a visually pleasing entrance to the Arboretum.

After approval of the Master Plan Update, in early 1980 the Arboretum Advisory Committee determined that priority for use of Arboretum Trust funds should go to the Irrigation System Replacement and to Conifer Meadow. So a process was set in motion to fill the Pit and create a Meadow.

The basic design was prepared by the landscape firm of Peterson and Buckingham. Plans were begun in May 1980 and completed in June, and provided the basis for a grading plan and permit. Over the winter of 1980-81, suitable soil was accepted from excavation projects in the Queen Anne area and on Capitol Hill. Thus, without any expenditure for soil, the Pit was filled, and finished grades were established in the summer of 1981. As part of the irrigation system, hose bibbs were installed and the area hydroseeded to lawn.

*Landscape Architect, University of Washington.

Bulldozing of the Conifer Meadow site.
Photo: J.A. Witt

Holes being dug for the trees. Photo: J.A. Witt

Young trees, at home in the new Conifer Meadow, May 1982. Photo: J.A. Witt

Since the majority of the trees were to come from the Arboretum nursery, it was decided in December 1981 that the University should be responsible for the planting. The planting design was prepared by the author and reviewed by faculty of the Center for Urban Horticulture, the College of Forest Resources and by the staff from the Seattle Parks Department. The basic program was to plant 200 conifers and 100 deciduous trees in a pattern which would provide relatively small open areas, screened from the surrounding traffic, eliminate the drainage erosion pattern and provide one major pedestrian walk. A significant location was found for a grove of redwoods of unusual varieties near the existing redwoods south of E. Lynn Street. An attempt was made to provide variety within species (in some proximity to each other), to provide space for future plantings of interspecific hybrids, and areas for demonstration of provenance plantings.

The majority of the trees came from the Arboretum nursery, including one 25-foot *Cupressus macnabiana*, but several large pines were moved in from the University of Washington campus nursery, together with a row of incense cedars, set as a barrier opposite the freeway off-ramp. *Cedrus* trees were planted along 26th Avenue East to mark the entrances to the small open areas. Two major areas of *Abies, Chamaecyparis* and x *Cupressocyparis* (*Chamaecyparis* x *Cupressus*), occupy the sides of the mounds; pines were generally planted with a southern exposure. Larch, *Torreya, Taiwania, Ginkgo* and a large *Taxodium* were placed as specimens. For seasonal effect, a few flowering crabs, birches (*Betula maximowicziana*) and Japanese maples were planted in loose clusters.

The project was bid, a contract was awarded to Landscape, Inc. and the work completed in May. Although much of the tree-moving was done in late March and April, care was taken to make certain that the root balls were kept moist so that very few (perhaps eight percent) have been lost through our long hot summer. The underdrainage installed down the swale lines appears to have handled our recent storms and the space is beginning to look like a part of the Arboretum.

A Letter to the Editor

Editor's Note: Judy Young is co-translator of Rhododendrons of China *(see* Arboretum Bulletin *44(4): 40, Winter 1981, Book Reviews).*

To the Editor:

After feasting on the visual and mental images of Jeanne Gardiner's three recent articles, I must respond to some specific items which are the result of our incomplete understanding of botanical matters in China.

During the last year, we in the Seattle area were very fortunate to host and develop friendships with four prominent botanists from China; they are sharing contacts and information with us which have been and will continue to be invaluable. In addition, scientific publications are pouring out of China as

never before; botanic journals and books are now directly available to us, as are bilingual technical dictionaries, scientific abstracts in English, and modern maps and atlases. This is a definite improvement upon our situation four years ago, when we began our translation job with a single third-person contact in Beijing and two old English-Chinese botanic dictionaries in the University of Washington library. We made plenty of mistakes along the way and learned from each of them.

The following comments are in reference to material in the third article, published in the Fall 1982 *Arboretum Bulletin,* specifically the photo caption on pages 22-23 and the epilogue on page 26:

1. The eminent professor in Chengdu is *Fang* Wen-pei, rather than "Feng" as printed. The difference in these surnames has a unique significance; in 1981 a beautiful book on the rhododendrons of Yunnan was published in Japanese, edited by Feng Kuo-mei of the Kunming Botanical Research Institute of Academia Sinica.

2. Fang Wen-pei is indeed a patriarch of rhododendron study in China. Among the treasures in our own university library collection are the folio-sized journals of the flora of Emei Shan (Mt. Omei) which he published in Chinese and English during the war years of the 1940's. Professor Fang was not, however, the person responsible for the work which we translated for *Rhododendrons of China.* The original rhododendron descriptions and key were from Volume III of the *Iconographia Cormophytorum Sinicorum,* a five-volume handbook to the most common and important plants of China. Intended as a relatively compact reference for general use, it was produced previous to and during the difficult years of the "Cultural Revolution," when authors' names were not permitted in books.

   After the translation was published, we received a letter from the man who had accomplished the task of editing the existing wealth of rhododendron material, adding new information, and fitting it all into a European taxonomic system. He is R.C. Ching of the Institute of Botany, Academia Sinica, in Beijing. Professor Ching is another patriarch of Chinese botany, a well-known fern taxonomist still working daily at the age of 84. A more detailed account of his work will be published this summer in *Horticulture Northwest;* it was written by his younger colleague K.H. Shing, who visited here last year under the sponsorship of the Northwest Ornamental Horticultural Society.

3. Not to be confused with other publications, the *Flora of China* is the major botanical project in China today. Also titled *Flora Reipublicae Popularis Sinicae,* or *Zhongguo Zhiwu Zhi,* it is scheduled for completion within a few years and will consist of 80 volumes, of which 29 are now in print and several more are soon to come. Editorial teams all over China have been assigned to carry out thorough studies of the various plant families and genera; fortunately the names of the botanists involved are now listed in each volume along with their institutions. Fang Wen-pei is one of several people preparing the three-volume *Rhododendron* section.

   Plant descriptions are detailed and the 7" x 10" format also includes frequent full-page line drawings. The text is in Chinese but plant names, descriptions of new taxa, table of contents, and an index are in Latin, and the often lengthy taxonomic references list foreign journals in their own languages. The East Asia Library at the University of Washington is acquiring the volumes as they become available, with the goal of eventually having a complete set for the use of the botanic/horticultural community.

Beyond discussion of these points of fact, I have personal concerns regarding the confusion which can occur in our Western perceptions of modern Chinese language, geography, and biologic science. Though these are complex subjects involving historical, cultural, and political questions, I hope eventually to have sufficient resources and time to explore them in depth. In the meantime, it seems that the traditional Chinese values of patience and perseverance, plus much recent good fortune, continue to serve us best.

JUDY YOUNG

The bee garden in the Arboretum, south of the greenhouses and lathhouses, supplies honey for the Arboretum plant sales. Don Hurlbert, beekeeper, is tending the hives. (Those of us who spend our daylight hours near the office buildings find our cars covered with beeswax during the active season. The bees love the *Ceanothus* at the corner of the offices.)
Photo: B.J.D. Meeuse

Honeybees, and Sensible Pesticide Use

*P. F. THURBER**

Bee Business

Each spring a number of gardeners living in Seattle or its suburbs call local hobby beekeepers and want to talk about pollination. They want to know about tree and vine fruit. They want to know how much hives rent for. The beekeeper will respond that the rent generally depends upon the crop to be pollinated, the time of its blossom and the duration of blooming. The gardener asks if the beekeeper can be more specific and explain why there would be a different rental fee for different crops. The better-informed hobbyist might

*Formerly vice president of the Washington State Beekeepers' Association and state apiary inspector, Mr. Thurber is presently editor of the newsletter of the Puget Sound Beekeepers' Association, and teaches beekeeping at Bellevue Community College.

explain that trees in a commercial apple orchard all come into bloom at the same time; just a very few good sunny days when bees can fly will result in a good fruit set. A farm of blueberries, on the other hand, is generally planted with different varieties that will be early-, middle- or late-blossoming. As a result the bees may have to be left at the farm for six weeks in order to produce a full crop set. You might think this long duration would be a reason for higher pollination fees, but since blueberry blossoms yield a fair amount of nectar for the bees' spring buildup and apple blossoms do not, the usual fee for apples and blueberries is about the same—$25 to $27.50 per hive. Since cranberries come into blossom when hives are already built up enough so that the bees perhaps will yield a second marketable crop of honey, the pollination fee will drop to roughly $16 per hive. The highest cost pollination is for western Washington cucumbers. These have a long blossom period and yield no marketable amount of honey. Furthermore the blossom time precludes the bees' being elsewhere when the major honey source, the fireweed *(Epilobium angustifolium)* is in bloom. Since the beekeeper is trading honey crop for pollination fees, the 1980 hive rental for cucumbers was in the $50-60 range per hive. Obviously, too, the cost of renting one hive will be relatively more than that of renting hives by the truck load because the moving expense for one hive may well be nearly as much as the expense of moving, say, a pickup load of twelve hives.

By this time the beekeeper is beginning to get a wee mite suspicious and sure enough the next question is—will the beekeeper rent one hive of bees? The answer is generally no. The offered rental fee is raised, and the answer is still no. Now lest you think beekeepers are uncooperative, let it be said most are not. On the other hand, keeping bees in the city or a suburb is tenuous at best and impossible in some areas. Generally the most difficult areas are the most affluent areas where it seems that nearly every day the various spray services have their rigs. However, even in less affluent sections of the city, a hive of bees might not last a week because of poor judgment by home owners in the matter of selection, mixing, and timing of application of pesticides.

Bumblebee worker *(Bombus californicus)* visiting a flower of comfrey *(Symphytum)* in the University of Washington Drug Plant Garden.
Photo: Tom Boyden

A honeybee worker *(Apis mellifera),* with pollen bags clearly visible, prepares to land on a flower of rock rose *(Cistus)* in the University of Washington Drug Plant Garden. Photo: Tom Boyden

Keeping the Bees in Mind, Guidelines for Home Pesticide Use

Now it begins to sound like the writer is anti-pesticide. This is not the case. We have pesticides at home, and they are used but they are used correctly. Let me tell you how we proceed.

We never spray until we see economic or esthetic damage. Spraying for an insect that has been eliminated in our area is a waste of time and money.

A general purpose insecticide by definition kills everything, so these are shunned. We do not use dust formulations, either. All are too hazardous.

For almost any pest there are probably insecticides. Before one is selected the lady with the green thumb in our house consults WREP 15 "How to Reduce Bee Poisoning from Pesticides." This fine information leaflet is annually revised by Dr. Carl A. Johansen of Washington State University. Dr. Johansen incidentally is probably the leading expert in the bee poisoning field in the English-speaking world, and his pamphlet is available from the county cooperative extension services in all the western states. The King County number is 344-2686. The Pacific Northwest Spray Guide is also revised annually, but it is expensive so if there is a problem again a call goes to the cooperative extension office. There either a master gardener or Ms. Sharon Collman, King County's entomologist, comes up with the selection. I think most master gardeners consider non-target insect problems when they recommend an insecticide, but I know Ms. Collman does.

We mow or pull blossoming weeds before we spray the lawn. In the case of a shrub or tree we never spray it in bloom. Again we remove blossoming weeds below a plant or tree before we spray. We time our spraying so that we do it when the bees are not flying—in the evening, so that the sprays have a chance to dry before the bees again forage. We also keep insecticides away from our fish pond which always has bees there getting a drink.

A common bee poisoning problem has nothing to do with flowers. Preparations that fertilize lawns and kill weeds at the same time may

also contain a pesticide to kill lawn moths. If bees drink dew from a just-treated lawn they probably will be poisoned. (Even the fertilizer-herbicides that do not contain a supplemental insecticide should be used with caution, not only to protect bees, but to protect humans! People and pets walking on treated grass will track herbicide into the house.)

We do use a dormant spray on the fruit trees; we use Benomyl against fungi and Dipel or Thuricide *(Bacillus thuringiensis* in solution) against tent caterpillars. For other insect pests we use Malathion at dusk when the honeybees and bumblebees are in bed. By morning the Malathion has biodegraded, and bees can forage on sprayed blossoms and not be killed. We also follow the label carefully—more is not better! More is often an ecological disaster.

Now let's be practical. If you want your garden to bear fruit, you have more to do than just personally use the right pesticides and use them correctly. Everyone has to explain proper pesticide use tactfully to the neighbors. For instance, if just one neighbor sprays an apple tree in bloom with an extremely potent all-purpose insecticide all the bumblebee and honeybee colonies for a mile or more around may well be killed. Bees forage for surprisingly long distances, and just a very few carrying a strong pesticide into the hive or nest can destroy it. There is documentation of honeybees foraging nine miles from their hive. This was an unusual situation, but for a particularly appealing nectar source bees have many times been tagged three to six miles from their hives.

Once we had fourteen species of bumblebees in the Seattle area, from the big ones down to the little pygmies. We had in fact ten species foraging on plants around our home in Kirkland just ten years ago. In the last three or four years we have seen no more than four species of bumblebees, but we sure have seen spray trucks on the streets and people buying pesticides. We even see people stocking up on pesticides because they are on sale. If the people would read the labels they would find in many cases they are buying pesticides for insects which are non-existent or so scarce in this area they do no esthetic or economic damage. This is folly and a waste of money.

In closing let me make one more point about honeybees. Many gardeners are aware that honeybees generally forage on one nectar or pollen source at a time. Because the bees are not working a particular bloom people think that they can safely spray it. If these people would sit quietly with me beside the front of a hive on a nice day, they would see that although most of the bees are foraging off one source, a few are not, as you can readily tell because the incoming pollen in the pollen baskets is a different color. So the old rule, "spray nothing in blossom," is the safest.

Plant Prejudice

"Landscapers who commit *Fatsia* should be jailed," a gardening friend scolded one day as we stood facing a planting of *Fatsia japonica* in my garden. Now, this friend is my dreadest and most beloved garden adversary, my Moriarty, with whom I am forever crossing plant prejudices. Moriarty won the day I must concede: my plant and my profession put down in seven words. Our on-going fracas seldom levels off at flat contrariness, however. Often we try to outprove each other with beautiful use of plants belittled by the other party.

And all my other gardening friends lodge at times their own zingers of prejudice upon me and my plants. Do these friends find me at times as exasperating as I find them? I suspect it. But is our communication as gardeners mutually vitalizing, a balance of trade, as it were, like that of two earthworms conjugating? I hope so.

While I'll advocate that gardeners' disagreements probably inspire the art of gardening with much of its vitality, sometimes I wish all that would go away. I wish we could admire each other's plants at their face values—at leaf values, that is—without carping about their commonness or gloating on their splendid rarity. I love to be there when children meet this or that plant for the first time; children take the new entity at leaf value—as do beginners at gardening—as do artists in fields other than gardening, who know next to nothing about plants.

With such a non-knowing artist and friend I stood before the *Fatsia* planting in my garden on another day, in winter. *Fatsia* was in full celebration, with ivory flowers and black orb berries presented simultaneously against leaves foot-wide, palmate, glossy ivy-green. Radiant plant! *Fatsia* to the eyes was as hot buttered rum to the inner being, and we stood there sharing the shrubs' warming beauty on that chill-bright day. It was one of those moments when we see the common plant as the nonpareil: nothing like it, nothing as good. A winter day is conducive to such clear vision; the evergreen in winter, a fine subject for review.

*GEORGE SCHENK**

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*George Schenk, already known to many people associated with the Arboretum, has been a Seattle-area gardener.

***Fatsia japonica* in flower at Volunteer Park, Seattle.** **Photo: B.O. Mulligan**

Classes of Interest

Urban Horticulture—Arboretum

These classes are open to the public; many of them start in early April. To register and for further information call (206) 545-8033.

RENOVATING AN OLD GARDEN, with Daphne Lewis, five Monday afternoon sessions.
BIRD IDENTIFICATION FOR BEGINNERS, with Merilyn Hatheway, six Saturday morning sessions.
DRAWING FROM NATURE (I AND II), with Kathy Barker and Laura Dassow, four Saturday morning sessions.
NATIVE TREES AND SHRUBS, with Gillian Lewis, five Saturday morning sessions.
FLORAL ARRANGEMENTS FOR THE HOME, with Sharon Thompson Buck, two Tuesday evening sessions.
CONTAINER GARDENS, with Margarett Luckell, four Saturday mornings.
EDIBLE PLANTS OF THE PACIFIC NORTHWEST, with Doug Benoliel and Tamara Buchanan, three Tuesday evenings and a Saturday field trip.
GARDENS OF VANCOUVER, B.C., with John A. Wott, one long Monday.
BEDDING PLANTS FOR INSTANT COLOR, with John A. Wott, two Wednesday evenings.
LAURELHURST GARDEN TOUR, with William Talley, one Saturday afternoon.
PLANT PROPAGATION: SOFTWOOD CUTTINGS, with Richard van Klaveren, two Saturday mornings.
CAMPUS TREE WALKS, with Van Bobbitt, two Saturday mornings.

Burke Museum

These classes begin the last week of April; call (206) 543-5592 for information.

REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS, with Tom Boyden, six evening lectures and three Saturday field trips.
INTERTIDAL COMMUNITIES OF PUGET SOUND, with Dan Bloedel, three lectures and two Saturday field trips.

Arboretum Foundation—Unit Council

These classes are open to all Arboretum Foundation members. Many of these courses begin in early April. For further information, please call the Arboretum Foundation office, (206) 325-4510.

PERENNIALS, with Lee Clarke and Jody Logan, one Monday and one Tuesday morning.
BEGINNERS' BOTANY, with Margaret Miller, two Monday mornings.
PRESSING PLANT MATERIAL, with Maxine Hagan, one Tuesday morning.
AN ARBORETUM HIGHLIGHTS TOUR, two Friday mornings.

University of Washington Continuing Education

Many of these classes begin in April. For information call Spectrum, (206) 543-2590.

IDENTIFYING PLANTS OF THE PACIFIC NORTHWEST, with Arthur R. Kruckeberg, eight evening sessions.
A SHORT COURSE ON THE COLUMBIA: THE COLUMBIA RIVER GORGE, with Michael Spranger, one Saturday.
THE BIRDS AND FLOWERS OF ORCAS IN SPRING, with Frank Richardson, a weekender.
NATURE PHOTOGRAPHY IN THE FIELD, with Tom Boyden, three weekend days.
SEASHORE LIFE OF PUGET SOUND, with Eugene Kozloff, one full Saturday.
LIFE IN THE SEA, with Karl Banse as coordinator, eight evenings.
MYSTERIES OF ANIMAL BEHAVIOUR, with Michael Hutchins, eight evenings.
WESTERN WASHINGTON WINERY TOUR, with C. Gerald Warren, two Saturdays.
CELESTIAL NAVIGATION, with Ric Weyrick, nine evenings.

Events of Interest

Don't forget the ARBORETUM FOUNDATION SPRING PLANT SALE, May 4 from 1 PM to 8 PM, and May 5 from 10 AM to 2 PM, in the Arboretum Administration Building parking lot.

Lectures in the Arboretum (Wednesdays, 10 AM to noon, in the Arboretum Classroom): DIAGONAL TRANSFER: SOUTHEASTERN PLANTS FOR NORTHWESTERN GARDENS, by Harrison L. Flint, April 6; LANDSCAPE PERCEPTION: ITS HORTICULTURAL RELEVANCE, by Andrew Gorski, May 18; THE ARBORETUM LIBRARY: ITS REORGANIZATION AND ITS FUTURE, by Lyn Sauter, June 15.

NOHS lecture series: USING NATIVE PLANTS IN THE NORTHWEST, by Arthur R. Kruckeberg, Wednesday, April 13, 10:30 AM, in the McCurdy Room of the Museum of History and Industry.

NATIVE PLANTS—THE OTHER SIDE OF THE COIN, public lecture by Harrison Flint, Tuesday, April 26, 7:30 PM, in Kane Hall on the University of Washington campus. Admission: $2.00.

HORT AF-FAIR RETURNS: the Hort AF-Fair for area high school students interested in horticulture is planned for April 20, 1983. This year's event is coordinated by Dr. John A. Wott, with Larry Fullner as the vocational horticulture chairman. Approximately 200 students will experience career explorations in urban horticulture, landscape architecture and plant maintenance. Jan Pirzio-Biroli and our capable guides will provide tours of the Arboretum. The Unit Council will assist with refreshments. We look forward to acquainting these young people with horticulture and the Arboretum.

SOUTH KING COUNTY ARBORETUM FOUNDATION PLANT SALE will be held on Friday, May 6, from 9 AM to 5 PM at the Golden Steer Restaurant boardwalk, Benson Center, Kent, at SE 240th Street and 104th Avenue SE. This sale benefits the Lake Wilderness Arboretum.

THE 1983 AMERICAN RHODODENDRON SOCIETY CONVENTION will be held in Portland, Oregon, May 5-8. For further information, please contact Harvey Welch, 4155 SW Hillsdale Avenue, Portland, Oregon 97201.

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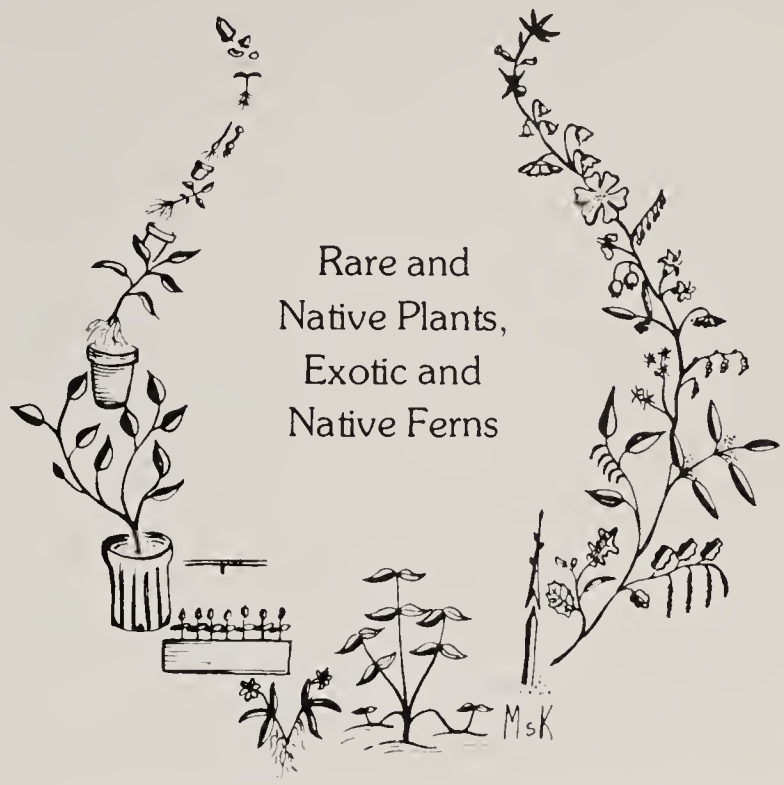

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The beautiful *Magnolia cylindrica*, blooming for the end of March. **Photo: W. Eng**

VISIT YOUR ARBORETUM IN SPRING

From the trunk to the bud
our attention is led
by the rising sap of spring.

View the early blooms of this early spring: the Arboretum has an excellent collection of Asiatic magnolias, that bloom on bare branches. *Magnolia sargentiana* var. *robusta* and other varieties are planted as a canopy among the rhododendrons, providing a sequence of color. In the renovated Camellia Collection, the plants are now visible as individuals, and will be flowering through this spring. And Azalea Way will be foaming with cherry blossoms.

PUBLIC TOURS OF THE ARBORETUM: these tours meet at the Arboretum Administration Building Parking Lot. SUNDAYS AT ONE, April 3, 10, 17, 24; May 1, 8, 15, 22, 29; June 5, 12. LUNCH-BREAK TOURS, Tuesdays at noon; April 5, 12, 19, 26; May 3, 10, 17, 24, 31; June 7, 14. TWILIGHT TOURS, Thursdays at 6 PM; April 7, 14, 21, 28; May 5, 12, 19, 26; June 2, 9. Join the EXPLORERS' WALKS, the fourth Wednesday of each month, 10 AM to noon; April 27, May 25, June 22.